

AD-A164 990

VOLUME 17, NO. 12
DECEMBER 1985



THE SHOCK AND VIBRATION DIGEST

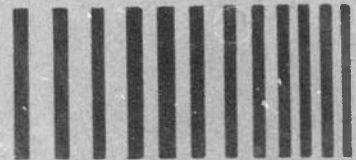
A PUBLICATION OF
THE SHOCK AND VIBRATION
INFORMATION CENTER
NAVAL RESEARCH LABORATORY
WASHINGTON, D.C.

DTIC
SELECTED
S MAR 05 1986 D
D

DTIC FILE COPY



OFFICE OF
THE UNDER
SECRETARY
OF DEFENSE
FOR RESEARCH
AND
ENGINEERING



Approved for public release; distribution unlimited.

86 3 5 035



THE SHOCK AND VIBRATION DIGEST

Volume 17, No. 12
December 1985

STAFF

Shock and Vibration Information Center

EDITORIAL ADVISOR: Dr. J. Gordan Showalter

Vibration Institute

EDITOR:	Judith Nagle-Eshleman
TECHNICAL EDITOR:	Ronald L. Eshleman
RESEARCH EDITOR:	Milda Z. Tamulionis
COPY EDITOR:	Loretta G. Twohig
PRODUCTION:	Deborah K. Blaha Gwen M. Wassilak

BOARD OF EDITORS

R.L. Bort	W.D. Pilkey
J.D.C. Crisp	H.C. Pusey
D.J. Johns	E. Sevin
B.N. Leis	R.A. Skop
K.E. McKee	R.H. Volin
C.T. Morrow	H.E. von Gierke



A publication of

THE SHOCK AND VIBRATION INFORMATION CENTER

Code 5804, Naval Research
Laboratory
Washington, D.C. 20375-5000
(202) 767-2220

Dr. J. Gordan Showalter
Acting Director

Rudolph H. Volin

Elizabeth A. McLaughlin

Mary K. Gobbett

The *Shock and Vibration Digest* is a monthly publication of the Shock and Vibration Information Center. The goal of the Digest is to provide efficient transfer of sound, shock, and vibration technology among researchers and practicing engineers. Subjective and objective analyses of the literature are provided along with news and editorial material. News items and articles to be considered for publication should be submitted to:

Dr. R.L. Eshleman
Vibration Institute
Suite 206, 101 West 55th Street
Clarendon Hills, Illinois 60514
(312) 654-2254

Copies of articles abstracted are not available from the Shock and Vibration Information Center (except for those generated by SVIC). Inquiries should be directed to library resources, authors, or the original publishers.

This periodical is for sale on subscription at an annual rate of \$200.00. For foreign subscribers, there is an additional 25 percent charge for overseas delivery on both regular subscriptions and back issues. Subscriptions are accepted for the calendar year, beginning with the January issue. Back issues are available -- Volumes 11 through 16 -- for \$40.00. Orders may be forwarded at any time to SVIC, Code 5804, Naval Research Laboratory, Washington, D.C. 20375-5000. The Secretary of the Navy has determined that this publication is necessary in the transaction of business required by law of the Department of the Navy. Funds for printing of this publication have been approved by the Navy Publications and Printing Policy Committee.

SVIC NOTES

Subject/Author Indexes for Annual Technical Meetings

Keeping track of the information received at annual technical meetings is a problem for attendees. If, like me, you have attended one or two meetings for several years, you probably have a five to ten year set of proceedings sitting on your bookshelf. By now, you find it difficult to find particular articles, especially the older ones. Others in your office find it even more difficult to find the same information because they didn't even go to the meeting. The proceedings gather dust and the return on the investment made by your organization to send you to the meeting and buy the proceedings becomes nil.

All of these problems would be solved if meeting organizers would, at regular intervals, publish a subject/author index of their proceedings. Such an index is a great time saver and allows an organization to extract the maximum benefit from the proceedings.

There are several key principles to follow when creating an index: (1) keep it simple, (2) design it to serve the needs of the meeting attendee, (3) base the subject index primarily on the titles of the individual meeting sessions followed by the most significant subject terms in the titles of the papers. The first principle, keeping the index simple, increases the likelihood that the index will be produced at regular intervals because production will be easier. The second and third principles are interlocked and logical. Ask the question, "in what way does the average person recall what they learned at a meeting?" Most likely they will remember the overall title of a session they actually attended such as PYRO-TECHNIC SHOCK or MODAL TESTING. They also might remember one or more major subjects from the title of a paper they heard or even the name of the author. It is logical then to create an index according to the above principles two and three, because it fits well with the way human memory operates.

If there isn't an index to your favorite set of proceedings, take steps to have one created; better yet, get on a working group to create one yourself. The best solution, of course, would be to have the meeting planners themselves put the index together.

JGS



Accession For	
NTIS CRA&I	<input checked="" type="checkbox"/>
DTIC TAB	<input type="checkbox"/>
Unannounced	<input type="checkbox"/>
Justification	
By <i>NRL \$40.00</i>	
Distribution /	
Availability Codes	
Dist	Avail and/or Special
<i>A-1</i>	<i>24</i>

EDITORS RATTLE SPACE

THE ENGINEER AND SOCIETY

In a recent article in *Science* magazine* an editorial, "The Status of Engineering", dealt with the role of the engineer in modern society. In essence Baker concludes that unless there is more media awareness and recognition of the engineering profession the standard of living in USA will decline. While this may seem like a naive and sweeping conclusion, it is not without basis. The conclusion is based on the premise that without recognition, encouragement, and reward a profession does not attract good people. Without talented persons we will not be able to design the complex systems required to maintain the status quo -- much less move ahead. Apparently some countries other than USA have been able to overcome this problem.

In my opinion, the signs of this decline are present. Our widening trade deficit means more than a lack of management. Much publicity has been given to Japanese style management; however, little significance is given to efficient production methods including the use of robots. The facts of life indicate that increased efficiency and productivity is necessary. Yet few of our schools remotely relate to production engineering. I do not fault the schools for this problem -- the motivation has to come from society. This leads me into another sign of decline. One of the most valuable resources of any society is its schools and universities. Today our university system is in jeopardy. Good people are not being properly recognized or rewarded. The result will be inferior training for future engineers. This means less innovation and ability to develop the complex systems required to function in the society of tomorrow. The fact that few engineers are taking graduate training and that talented professors are leaving the university because of financial hardship are adequate signs of decline. The design of the complex interdisciplinary systems of tomorrow will require more training and better physi-

cal understanding than ever required in our present space age.

Baker comments that the public is more aware of scientists and science than of engineers. I believe this is only true for the case of persons involved in the life sciences. The media deal with the life sciences quite well -- largely because the average person in society can relate to this area. I don't think the media deals any better with physical scientists than engineers. It is a fact that the average person in society is unaware of what an engineer does -- nor does he or she care. To the public, the engineer is some mystical genius who uses a lot of math to do his or her job. In recent years I have been increasingly aware of the life science orientation of educational programs on television. The little exposure I have had in other countries showed this was not true. Furthermore I cannot explain why the media have neglected physical systems and all that is associated with them. Even the space shuttle did not help the situation. Perhaps it is because engineers and scientists are satisfied to quietly do their job. Perhaps it would be good for both them and society if they were more vocal. The successful people that I have known were successful not only because they were talented but also because they let people know of their accomplishments.

In my opinion, society is going to have to become more aware of engineers and what they do if we are to increase recognition and reward -- those factors necessary to increase the productivity, ability, and ingenuity required to maintain and increase our standard of living. Only the media have the power to accomplish this task. Perhaps engineers will have to be more vocal and educate the media on these facts of life.

R.L.E.

*Baker, D. Kenneth, "The Status of Engineering," 230 (4721), 4 October 1985, p 13.

ACOUSTIC EMISSIONS FROM WIRE AND SYNTHETIC ROPES

P.A.A. Laura*

Abstract. The rupture of mechanical cables used in towing operations, remote control of equipment, and salvage operations can result in loss of both life and equipment. Accordingly, reliable and simple methods to assess the structural integrity of mechanical cables are of utmost importance. The present paper is a brief review of applications of the acoustic emission method from the point of view of the nondestructive evaluation of wire and synthetic ropes and monitoring their mechanical status while in operation.

Cables and cable systems are extremely important in ocean and coastal engineering; e.g., mooring buoys and vessels, towing and trawling operations, supporting underwater instruments. Such systems also constitute essential structural elements in tension leg platforms and suspended bridges [1].

As stated by Harris and Dunegan [2] "the extensive use of wire rope in a wide variety of applications, and the difficulty of nondestructively evaluating the integrity of rope by conventional techniques, has led to an increased interest in the acoustic emission characterization of such components." Similar considerations are valid in the case of synthetic ropes. Acoustic emission techniques have been used in applications ranging from nuclear reactors and space vehicles technology to materials research.

Acoustic emission phenomena begin when a crack propagates in a stressed solid. A portion of the strain energy stored in the body is released and a compression wave is propagated. The resulting particle motions can be picked up by transducers placed at the surface of the solid. Acoustic emission techniques are very sensitive to wire or fiber breakage and are, therefore, well suited for monitoring the structural status of wire [3] or synthetic rope [4] and for performing nondestructive evaluation.

ACOUSTIC EMISSIONS IN THE CASE OF WIRE ROPE

A brief review of research into failure mechanisms of cable ropes and the acoustic emission signatures of the various cables has been published [5]. Early uses of the acoustic emission method to detect deterioration of a cable prior to complete failure were motivated by the loss of the deep submersible ALVIN [3]. These early investigations showed that clearly audible stress waves were emitted at approximately 95 percent of the maximum load allowed.

Harris and Dunegan [2] extended early investigations and performed cyclic loading experiments and rising load tests. They obtained several important results:

acoustic emission techniques can be used to measure the number of wires that break during a given loading of a cable

faulty cables can be easily distinguished by the acoustic emission method

continuous acoustic monitoring of fatigue cycling of cables is easily accomplished and provides ample warning of impending fatigue failure

From the point of view of developing a realistic, operational system the most important contribution was work performed at the Defence Research Establishment between 1976 and 1979 [6]. The research program has resulted in a thorough understanding of the acoustic response from an AN/SQS 505 VDS (variable depth sonar) tow cable and use of that information to safeguard a towed body from loss due to fatigue failure of the cable. An impressive amount of experimental work was performed that made it possible to design a

*Director and Research Scientist, Institute of Applied Mechanics, Puerto Belgrano Naval Base, 8111 - Argentina

cable monitoring system. The transducer and preamplifier are mounted at the point of most probable failure of the VDS cable: the sea-end cable termination.

ACOUSTIC EMISSIONS IN THE CASE OF SYNTHETIC ROPE

It has been stated [7] that "the rupture of a synthetic fiber rope (or line in marine use) under stress is often associated with an explosive snapback."

"Any object or individual in the path of the rope snapback may suffer serious damage or injury. In spite of a distinct need for nondestructive evaluation (NDE) procedures for the structural integrity assessment of new and used synthetic lines, NDE procedures are currently limited to visual examinations."

Vanderveldt and Tran [4] were the first researchers to apply the stress wave emission monitoring method to the study of synthetic ropes. They examined three different types of braided synthetic rope: nylon cover over nylon core, polyester cover over polypropylene core, and nylon cover over polypropylene core. An accelerometer was used to detect stress waves in the procedure utilized [3].

Vanderveldt and Tran [4] showed that an increase of at least an order of magnitude in the slope of the curve of the number of stress wave emissions vs the applied load is a good indicator of impending catastrophic failure. No significant differences in stress wave emission characteristics were observed for the three types of synthetic ropes considered [4].

Acoustic emissions of synthetic ropes subjected to loading have been studied by other researchers. Important results were obtained by Williams and Lee [7]. Recently the NDE technique of acoustic-ultrasonic testing has been applied to nylon ropes [8].

The NDE technique of acoustic-ultrasonic testing involves introduction of an ultrasonic pulse into a structural system via a transmitting transducer. The dynamic disturbance is detected by a receiving transducer

mounted on the same face of the structure. The result is generally defined as the stress wave factor (SWF). The SWF is evaluated as the number of threshold crossings of the ring-down oscillations in the output signal from the receiving transducer. This parameter indicates the relative efficiency of energy transmission at the receiver frequency [8].

Acoustic-ultrasonic NDE have been conducted on new dry Samson double-braided 2-in. nylon rope [8]. Stress wave factors were determined at various tensions for undamaged, core cut, core removed, and cover cut rope samples. This excellent study shows that there are characteristic SWF vs load properties for undamaged and damaged ropes.

However, the SWF characteristics are caused by complex mechanisms. Two variables with considerable, competing effects are the transducer-rope contact area and the rope compaction coupling between all the structural members: fibers, yarns, core, and cover. As stated by the investigators [8], "the SWF characteristics are due to rather complex mechanisms. Thus, applications of the stress wave factor in the NDE of structures in general, and synthetic fiber ropes in particular, should be coupled with adequate SWF modeling to achieve the maximum capability and the proper interpretation of the results of this test technique."

REFERENCES

1. Lo, A. and Leonard, J.W., "Dynamic Analysis of Underwater Cables," ASCE J. Engrg. Mech. Div., **108**, pp 605-621 (1982).
2. Harris, D.O. and Dunegan, H.L., "Acoustic Emission Testing of Wire Rope," *Matls. Eval.*, **15**, pp 1-6 (1974).
3. Laura, P.A.A., Vanderveldt, H.H., and Gaffney, P., "Mechanical Behavior of Stranded Wire Rope and Feasibility of Detection of Cable Failure," *Marine Tech. Soc. J.*, **4**, pp 19-32 (1970).
4. Vanderveldt, H.H. and Tran, Q., "Acoustic Emissions from Synthetic Rope," *Naval Engrs. J.*, **83**, pp 65-68 (1971).

5. Laura, P.A.A. and Matthews, J.R., "Monitoring the Status of a Mechanical Cable While in Operation by Means of the Acoustic Emission Method," Ocean Engrg. (1985).

6. Matthews, J.R. and Black, M.R., "Acoustic Emission Signature at Variable Depth Sonar Tow Cable," Intl. Advances Non Destruc. Test., 7, pp 181-214 (1981).

7. Williams, J.H. and Lee, S.S., "Acoustic Emission Rupture Load Characterizations of Double-Braided Nylon," Marine Tech., 19, pp 268-271 (1982).

8. Williams, J.H., Hainsworth, J., and Lee, S.S., "Acoustic-Ultrasonic Nondestructive Evaluation of Double Braided Nylon Ropes Using the Stress Wave Factor," Fibre Sci. Tech., 21, pp 169-180 (1984).

LITERATURE REVIEW: survey and analysis of the Shock and Vibration literature

The monthly Literature Review, a subjective critique and summary of the literature, consists of two to four reviews each month, 3,000 to 4,000 words in length. The purpose of this section is to present a "digest" of literature over a period of three years. Planned by the Technical Editor, this section provides the DIGEST reader with up-to-date insights into current technology in more than 150 topic areas. Review articles include technical information from articles, reports, and unpublished proceedings. Each article also contains a minor tutorial of the technical area under discussion, a survey and evaluation of the new literature, and recommendations. Review articles are written by experts in the shock and vibration field.

RECENT RESEARCH ON TURBULENT FLOW NOISE MECHANISMS

D.F. Long* and R.E.A. Arndt*

Abstract. This article is concerned with the pressure field generated by large-scale coherent motions in turbulent flows. A general decomposition is discussed that evaluates the magnitude of the coherence in an unbiased way. This tool is described in terms of two flows of current interest, jets and boundary layers.

As with most disciplines, the experimental techniques used in turbulence research follow from what is believed to be the physics of the problem. Turbulence was once thought to be a random and chaotic motion of parcels of fluid riding upon a given mean flow pattern. Previous measurements reflect this view. The structure of a turbulent boundary layer, for instance, was thought to be describable in terms of regions of the mean velocity profile. Such terms as sublayer, buffer layer, logarithmic region, and wake region are typical [1].

There has been an increasing awareness that the fluctuating component may not be totally random. Flow visualization studies indicate that, in addition to the mean and random components of the motion, there may be a third term, which is known as a quasi-coherent motion. Spurred by visualization in boundary layers [2, 3] and in jets and shear layers [4-7] investigators began to study whether the presence of this quasi-coherent motion played a major role in turbulence dynamics. Such words as bursts, sweeps, and streaks were used to describe the boundary layer structure in place of words based on mean velocity profile. A similar trend was noted in studies of jets and shear layers.

Some investigators [8, 9] then began to question the role played by these coherent structures in the noise radiation process, mostly in jets and to a limited degree in boundary layers. It was noticed that these

large-scale structures were readily observable at Reynolds numbers based on jet diameter less than 10^7 but disappeared at higher Reynolds number. Curiously, changes in radiated noise also occurred, depending on whether the Reynolds number was less than or greater than 10^5 [10, 11]. Some investigators thought that the large scales might still be present but were masked by the high level of small-scale turbulence [8].

Any of three possible mechanisms might actually produce the noise. One is the traditional view that the turbulence is composed of a large number of random turbulent eddies acting independently and that the noise is produced by collisions and vibrations of small-scale eddies [12].

A second possibility is that the large-scale structure produces noise directly. An example is a jet excited by a pure tone. At a very specific condition [13, 14] the jet can be made to produce discrete tones in the noise spectrum that can be directly related to the large structure. It is thought that successive vortex pairings cause a fluctuating stress that acts as a noise source and produces the tones. It is not known if this mechanism occurs in unexcited or natural jets to any significant degree.

It is the third possibility that we feel is most plausible for natural jets and possibly boundary layers: the large-scale structure acts as a modulator of the smaller scales that actually produce the noise. The large scales may thus be making the process either more or less efficient. Obviously, this concept is very difficult to prove conclusively, but there is some evidence to support it [8, 9].

Traditional jet noise experiments [15, 16] were conducted assuming that the first possibility was the correct mechanism. The

*St. Anthony Falls Hydraulic Laboratory, University of Minnesota, Minneapolis, MN 55414

experiments were generally designed to verify the theory [12, 17] through measurements of intensity, directivity, and spectral density. The general features were verified; subtle discrepancies were explained away as due to scattering and interference effects. In view of the possible presence of coherent structures, these subtleties should be reexamined.

Far-field measurements are doomed to failure in determining the nature of the source in part because of the extremely small amount of total jet power that is radiated as noise. The acoustic radiation efficiency of a subsonic jet is on the order of 10^{-4} times the Mach number to the fifth power [15]; the noise source mechanism is therefore associated with a very small fraction of the local turbulence energy. It seems likely then that the radiated noise does not result from gross features of the turbulence but from a much more subtle interaction. Therefore, attempts at a correlation between far-field noise and local turbulence appear tenuous at best.

If measurement procedures are as unbiased as possible, subjectivity is restricted to interpretation of results. If a procedure is applied to many similar experiments, subtle interactions and differences may provide a clue to the radiated noise problem. At present, however, every experiment is conducted differently and, due to individual bias, not only the results but also the measurement procedures are subject to interpretation. Two similar experiments can appear to show opposite results due to the measurement techniques employed [18, 19].

Two experimental situations in which radiated noise is of concern are considered below: jet noise (the most obvious example) and boundary layer noise. A proposed procedure is to decompose the fluctuations associated with the turbulence into orthogonal components; i.e., the so-called Karhunen-Loeve, or K-L, expansion. These components are related to the structure of the turbulence and discussed in terms of possible noise generators. Homogeneous and stationary random variables are also briefly discussed.

STATIONARY AND HOMOGENEOUS PROCESSES

The significance and usefulness of the K-L expansion rests in its use in nonhomogeneous and nonstationary situations. Stationarity traditionally refers to a time signal; homogeneity refers to a spatial structure. From an analytic point of view they mean the same thing; i.e., only relative distances are important in terms of statistics. As far as the time signal is concerned, the random signal under consideration has the same general character at present as it will at a later time; the mean level, rms level, and higher order moments are invariant. As far as spatial variables are concerned, the correlations and length scales are invariant from point to point.

The alternative to either situation is that the signal is either nonhomogeneous or nonstationary. A few specific examples illustrate the point. For instance, the acceleration of a body immersed in a fluid or the start-up of a wind tunnel are examples of a nonstationary process; the motion of a body at constant velocity through a fluid or the continuous operation of a wind tunnel are stationary.

Note that an experiment could be classified either as stationary or nonstationary depending on the desired result. A cavitation experiment is an example. The overall situation is stationary; that is, the character of the output signal is the same at any instant. On the other hand, the output of a single cavitation event is nonstationary. There is no noise before the event. The event causes an intense pop that is followed by a few oscillations due to the bubble rebounding. The character of this event is not the same at any instant. A single event is nonstationary but the whole experiment is stationary.

Spatial variables can be treated similarly. They are either homogeneous or nonhomogeneous. However, because space is described by a vector comprised of three perpendicular directions, it is direction that is homogeneous or nonhomogeneous.

A simple example is two-dimensional shear layer. The flows have been studied extensively in laboratory experiments because

they show all the features of more complex flows. The three independent directions are denoted in the usual sense by x , y , and z ; the orientation of the mixing layer is shown in Figure 1.

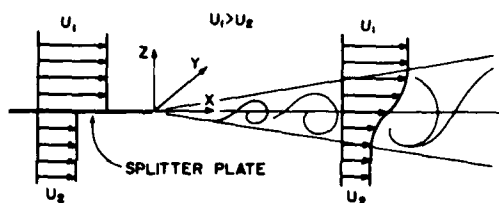


Figure 1. Mixing Layer Orientation

The transverse direction y is homogeneous because the flow variables should have the same general character from one point to the next. The existence of end plates or a finite width channel must be neglected; only the interior portion can be considered homogeneous. For a large aspect ratio (width/height > 10) this is a satisfactory approximation.

The vertical direction is strongly nonhomogeneous; the flow properties change significantly from one point to the next. This is easily seen by noting the change in the rms fluctuation level across the layer. The center has a high intensity that dies off almost to zero in the two free streams. Other properties and moments also change, but the vertical direction can be defined as nonhomogeneous.

The streamwise direction is also nonhomogeneous; small-scale eddies occur close to the origin of the mixing layer, and larger scales occur further downstream. Each eddy scale exists for only a limited spatial range.

Even the simplest turbulent flows are nonhomogeneous in at least one direction. In fact, three-dimensional homogeneous turbulence is difficult to find except in the limited context of grid turbulence in a wind tunnel. Nonhomogeneity is the rule rather than the exception.

THE ORTHOGONAL DECOMPOSITION — AN UNBIASED APPROACH

The orthogonal decomposition, or Karhunen-Loeve (K-L) expansion, is a technique for studying the spectral content of a nonhomogeneous direction or a nonstationary process. The objective is to decompose the original signal into its component eigenvalues and eigenfunctions. This is similar to Fourier analysis of a signal, but Fourier methods are restricted to stationary or homogeneous processes. Both methods seek an energy content (eigenvalue) and a characteristic form (eigenfunction). The difference is that in Fourier analysis the forms of the eigenfunction are known; they are the harmonic functions. It can be shown that the K-L expansion reduces to the harmonic decomposition if the independent variable is homogeneous.

Even though the K-L expansion is a generalization of Fourier methods, it is not widely used in turbulence analysis. The reason is partly that the technique was only recently introduced to the turbulence community [20] and partly because of the enormous amount of input data required. A nonhomogeneous variable requires an amount of input data equivalent to that of a homogeneous variable squared. If an adequate description of a homogeneous variable can be obtained from ten measurements, a similar description for a nonhomogeneous will require 100 measurements. The measurement that is typically necessary is the cross-spectral density between two measurement probes.

The technique centers around the eigenvalue problem

$$\begin{aligned}
 (1) \quad & R(x, x'; y, y'; \dots; t, t') \\
 & V^{(n)}(x', y', \dots, t') dx', dy', \dots, dt' \\
 & = |\lambda|^2 V^{(n)}(x, y, \dots, t)
 \end{aligned}$$

This problem is a result of decomposing the original signal into its component eigenvalues and eigenfunctions. For instance, for a scalar random signal P

(2)

$$P(x, y, \dots, t) = \sum_{n=1}^{\infty} \lambda^{(n)} \xi_n V^{(n)}(x, y, \dots, t)$$

The $V^{(n)}$ form an orthonormal basis and the eigenvalues contain the amplitude information. This can be developed into equation (1) where $R(x, x'; \dots)$ is the covariance of P [21]. Formally this covariance is the expected value of P over all lags,

(3)

$$R(x, x'; y, y'; \dots; t, t') \\ = E\{P(x, y, t), P(x', y', t')\}$$

Without too much difficulty, it can be extended to a vector field U_i instead of the scalar P . The covariance becomes a tensor valued function $R_{ij}(x, \dots)$. For the present, scalar functions only are used for simplicity.

Equation (1) can be interpreted independently for each independent variable. Because time is a stationary variable in most situations, it can be treated by a Fourier transform. The Fourier transform of equation (1) can be written as

(4)

$$S(x, x'; y, y'; \dots; \omega) V^{(n)}(x', y', \dots; \omega) \\ = |\lambda^{(n)}|^2 V^{(n)}(x, y, \dots; \omega)$$

S is the cross-spectral density function between two measurement locations and can be determined by standard methods. The resulting eigenvalues and eigenvectors* are interpreted for each frequency component. This process can be repeated for each homogeneous direction. The resulting matrix equation need only be solved for the nonhomogeneous directions.

The solution to equation (4) is easily obtained by the power method. The power method, which is discussed in most texts on numerical methods, is an iterative scheme in which eigenvalues and eigenvectors are produced in order of importance. After a solution is obtained, the eigenvalues and

*In theory, the covariance and the eigenfunctions are continuous functions; in practice, discrete probe locations must be used. The kernel in equations (1) and (4) thus becomes a matrix, the eigenfunctions become eigenvectors, and the integral becomes a summation.

eigenvectors are the complete spectral representation of the problem. They can be interpreted in much the same fashion as a spectral density.

An alternative to harmonic decomposition for stationary variables is the shot-noise decomposition. This technique is useful for obtaining information about time-dependent qualities of flow. It can be incorporated with the orthogonal decomposition into a valuable method that allows a quantitative measure of coherent structures in turbulent flows [20].

The shot-effect was developed for studying the statistics of vacuum tube noise when a pulse is emitted every time an electron reaches the anode [22]. It defines the statistical variation of a sequence of pulses with constant amplitude, a well-defined shape, and random arrival times at the anode. Regardless of how well the pulses are defined, the probability distribution of the signal will be normal because of the random arrival times. The randomness of arrival time implies that the individual pulses are independent of one another; the central limit theorem guarantees the normality of the distribution. The moments of the distribution associated with the pulse are indeterminate from standard statistical measurements. However, the measured spectrum is the Fourier transform of an individual pulse. The characteristic shape of the individual pulse can be reconstructed from the inverse Fourier transform of the measured spectrum. The full complex spectrum is necessary, however; the amplitude or power spectrum is not sufficient. The full complex spectrum is easily obtained from the results of the orthogonal decomposition. The individual pulse shape thus determined is called a characteristic event.

A brief development [20] is now considered for a scalar field $P(x, t)$; x represents nonhomogeneous direction and t represents stationary time.

It is supposed that the signal can be decomposed as

(5)

$$P(x, t) = f(x, t) * g(x, t)$$

The * represents a convolution with respect to time, f is the characteristic event, and g is a random strength function similar to the random arrival time concept. This representation must be used instead of the original shot-noise because the function is continuous rather than a sequence of discrete functions.

It can be shown that

$$(6) \quad S(x, x'; \omega) = F\{f(x, t)\} F^*\{f(x', t)\}$$

$S(\omega)$ is the measured spectrum, and F stands for the Fourier transform of the quantity inside the brackets. For $x = x'$ the deterministic function f is found from

$$(7) \quad F\{f\} = [S(\omega)]^{1/2} e^{i\beta}$$

β is an arbitrary phase angle. Different choices for β will lead to different representations of the form given by equation (5). The representation sought is the one that is consistent with the results of the orthogonal decomposition. The quantity defined in equation (6) is equivalent to the kernel in equation (4) and hence can be expanded into the sum of its eigenfunctions. Only the dominant eigenfunction is sought; the remaining functions are neglected and are interpreted essentially as noise in a communication sense [20]. The complex spectrum, with the appropriate choice for β , is given by

$$(8) \quad S(\omega)^{1/2} e^{i\beta} = \lambda_1(\omega) \psi_1(\omega)$$

This choice for β is entirely arbitrary. There is no guarantee that it is correct, but it is believed to be a rational choice.

The spectrum $S(\omega)$ could be called the characteristic spectrum because it determined directly the characteristic event f . Used in conjunction with one another, equations (7) and (8) produce the characteristic event in time, $f(\tau)$, at any particular location x . A more complete description of these developments, as well as its application to an experimental situation, is available [23].

The decomposition has been used previously to a very limited extent. Two Ph.D. theses

were conducted under the supervision of Professor J.L. Lumley at the time the technique was being developed. One was an attempt to elucidate the nature of a viscous sublayer [24]. Results showed qualitative agreement with the structure deduced from flow visualization. The other thesis was a study of the wake structure behind a circular cylinder [25]. Results from this experiment were somewhat surprising. The large eddy structure was found to be two counter-rotating vortex pairs whose axes are perpendicular to both the mean flow direction and the cylinder center line. Applications in which turbulence-induced noise is of concern include jet noise and boundary layer noise and vibration.

JET NOISE

The most important practical problem in the area of turbulence-induced noise is jet noise. The problem can be attacked in a number of ways. In the original theoretical development [17] the nonhomogeneous wave equation

$$(9) \quad \frac{\partial^2 \rho}{\partial t^2} - \frac{1}{a_0^2} \frac{\partial^2 \rho}{\partial x_i^2} = \frac{\partial^2}{\partial x_i \partial x_j} T_{ij}$$

was derived. T_{ij} is the Lighthill stress tensor, which for practical purposes is given by the approximation

$$(10) \quad T_{ij} = \rho_0 U'_i U'_j$$

The quantity on the right side of equation (10) is considered the source term. The approximate solution is found as [17]

$$(11) \quad \rho = \rho_0 - \frac{1}{4\pi a_0^2} \frac{x_i x_j}{x^3} \int \frac{1}{a_0} \frac{\partial^2}{\partial t^2} [T_{ij}] dy$$

The brackets indicate that T_{ij} is evaluated at the retarded time, $t - r/a_0$.

One possible mode of attack would be to measure the appropriate turbulence quanti-

ties in order to specify T_{ij} accurately, insert the value into equation (11), and solve the equation numerically for the density perturbation. However, this monumental task cannot be carried out; in addition, the nature of the noise sources would not be elucidated. The problem with direct computations of this type is that the most important terms are not singled out.

A better procedure would be to insert certain candidate structures into T_{ij} to test their effectiveness as noise radiators. The candidate structures could be obtained from the results of the orthogonal decomposition. The simplest case would be a test of the hypothesis that the large structures radiate noise directly. The idea has been proposed before, but the candidate structure -- vortex pairing -- was merely suggested [126]; it was not found from an unbiased experiment. To date there is no experimental evidence that vortex pairing occurs in an experiment involving high Reynolds number and high Mach number.

A candidate for T_{ij} would be much more difficult to formulate if large-structure small-structure interaction is the dominant noise source. The large structure could result from the orthogonal decomposition, but incorporating the random small scales may be difficult. Interactions of this type have been studied theoretically, but both large scales and small scales were hypothesized [27]. If large scales resulting from the decomposition are used, various scenarios could be tested in an attempt to determine how the interaction takes place. This idea has been put forth previously [8].

An alternative to using the result of the decomposition as data for equation (11) would be to compare the result directly to an orthogonal decomposition of the noise field. This comparison shows the most promise for discovering the nature of the noise sources. It has been attempted in a cooperative effort involving the St. Anthony Falls Hydraulic Laboratory and two other institutions. Each institution was to carry out a difference phase of the experiment. Problems arose because three facilities and three different size nozzles (different Mach numbers but the same Reynolds number were used; a more complete description is available [28]. The conclusion reached is

that the experiment must be conducted in one facility at a constant Mach number. Turbulence studies conducted at low Mach number -- where hot wires are easy to use -- cannot be used to infer the nature of noise sources at higher Mach number.

BOUNDARY LAYER NOISE AND VIBRATION

The physics of boundary layer noise are sufficiently different from jet noise that the preceding ideas are not directly applicable. It is believed that the coherent structure plays a dominant role in jet noise. They play a more passive role in boundary layers. Noise and vibration resulting from a boundary layer occur at low wave numbers. (Low wave numbers are defined as those with wavelengths much longer than the boundary layer thickness.) Turbulence induces low wave number pressure fluctuations along the boundary that are efficient in radiating noise. Such pressure fluctuations are of prime interest in underwater sound and structural vibration. The problem is that the amplitude is so low that measurements accurate enough to be compared with various theories have yet to be conducted. All efforts have thus far failed. An orthogonal decomposition using some new techniques in spectral estimation designed specifically for this situation is outlined below.

The pressure fluctuations at any point along the boundary are considered stationary and homogeneous. Strictly speaking the boundary layer grows in the downstream direction, but growth is slow enough to be approximately homogeneous. The cross stream direction is strictly homogeneous, but at present this direction is neglected. Only streamwise fluctuations are of concern. The pressure signal is written as

$$(12) \quad P = P(x, t)$$

where x is the streamwise coordinate and t is time.

The appropriate decomposition for each variable is the harmonic decomposition by Fourier transform methods. This is easily carried out on a digital computer by a fast Fourier transform (FFT) algorithm. It is

accurate only if sufficient data are available. In the time domain sufficient data are easily obtained by choosing an appropriate sampling rate and sampling period. Generally 256 points or 1024 points are used.

A practical limitation on the number of transducer locations in the spatial domain arises for two reasons: only a finite number of transducers can be fitted into the measurement area, and considerable effort is required to obtain 256 separate correlation measurements. Thus, even though Fourier analysis is correct, the FFT algorithm cannot be used to decompose the spatial structure because of finite data length. Alternative spectral estimators geared to the limited number of transducers must be sought.

The most common spectral estimator for this application is called beamforming [29]. A finite transducer array is used to define the beam power for frequency ω

(13)

$$b_n(\omega) = \frac{V_n^H S(\omega) V_n}{K^2} \quad n = 1, N$$

$S(\omega)$ is the cross-spectral density matrix, V_n is the steering vector, and N is the number of transducers. The steering vector takes the form

$$(14) \quad V_n^i = \exp\{j(kd_i - \phi)\}$$

where d_i is the distance between the transducers and ϕ is an arbitrary phase. The most common form used in boundary layer pressure measurements is an alternating phase array [30]. Different transducer separations are used to steer the array to different wave numbers; the full wave number spectrum cannot be found from a single array.

An alternative to beamforming now being developed belongs to a class of spectral estimators known as the maximum likelihood method (MLM) [31]. The technique was originally developed for geophysical problems but has been used for estimating

source bearing in radar and sonar applications. It appears to produce better agreement with model spectra [32] than beamforming but has not yet been applied to actual data.**

The wall pressure signal is written as in equation (12); the desired output is harmonic decomposition of each of the independent variables x and t . Thus, the desired output is in the form of a frequency wave number spectrum $\phi(\omega, k)$ in which the amplitude or energy content is given as a function of frequency ω and wave number k .

The general procedure is to perform a frequency decomposition for every possible pair of transducers. A cross-spectral density matrix of the form

$$S(x, x'; \omega) = \begin{bmatrix} \square & \square & \square & \dots & \dots \\ \square & \square & \square & & \\ \square & & & & \\ \vdots & & & & \\ \vdots & & & & \end{bmatrix}$$

can be written for each frequency component ω . This matrix is the same as that given in equation (4). The variables x and x' denote measurement locations. The elements on the main diagonal of this matrix correspond to power spectra; the off-diagonal elements correspond to cross power spectra for various transducer separations. This set of matrices, one for each frequency component, is operated on by the MLM to estimate the wave number frequency spectrum.

The output of the application of the MLM to each matrix is in the form of a wave number spectrum for each frequency. The method applied to Chase's [32] model spectrum is shown in Figure 2. The MLM spectrum reproduces the Chase model much better than the direct Fourier transform estimate (beamforming) over the entire wave number spectrum. In the future the method will be fine tuned to focus on the low wave number region.

**A more complete technical manual on the MLM is being developed by the authors of reference 31.

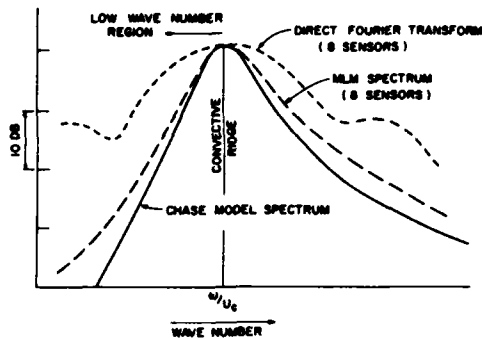


Figure 2. Comparison of the Direct Fourier Transform Spectral Estimation (Beamforming) and the MLM Spectral Estimate Using Chase's Model as the Input

SUMMARY

The techniques described in this paper are aimed at identifying patterns in the turbulence responsible for noise and vibration. Previous efforts in this direction suffered from some bias associated with the procedure. The intent has been to eliminate this bias as much as possible and to let a rigorous analytical black box reduce the large structure from the random field. The resulting quantitative measure can be compared to other programs using the same analytical black box to study turbulence changes in response to different parameters.

With the advent of high-speed digital data acquisition and computing circuitry, the problem of implementing the black box has been eliminated. It is hoped that these techniques will be used more often in the future to establish a larger data base from which useful comparisons can be made.

ACKNOWLEDGEMENTS

Thanks are due to M. Kaveh and G. Wakefield of the Electrical Engineering Department at the University of Minnesota for supplying information on the maximum likelihood method. This work was sponsored by the Office of Naval Research.

REFERENCES

1. Schlichting, H., *Boundary Layer Theory*, 7th Edition, McGraw-Hill (1979).
2. Kline, S.J., Reynolds, W.C., Schraub, F.A., and Runstadler, P.W., "The Structure of Turbulent Boundary Layers," *J. Fluid Mech.*, **30**, p 741 (1967).
3. Corino, E.R. and Brodkey, R.S., "A Visual Investigation of the Wall Region in Turbulent Flow," *J. Fluid Mech.*, **37**, p 1 (1969).
4. Becker, H.A. and Massaro, T.A., "Vortex Evolution in a Round Jet," *J. Fluid Mech.*, **31**, p 435 (1968).
5. Beavers, G.S. and Wilson, T.A., "Vortex Growth in Jets," *J. Fluid Mech.*, **44**, p 97 (1970).
6. Winant, C.D. and Browand, F.K., "Vortex Pairing: The Mechanism of Turbulent Mixing Layer Growth at Moderate Reynolds Number," *J. Fluid Mech.*, **63**, p 273 (1974).
7. Brown, G.L. and Roshko, A., "On Density Effects and Large Structure in Turbulent Mixing Layers," *J. Fluid Mech.*, **64**, p 775 (1974).
8. Arndt, R.E.A. and George, W.K., "Investigation of the Large Scale Coherent Structure in a Jet and Its Relevance to Jet Noise," 2nd Symp. Transportation Noise, Raleigh, NC, p 142 (1974).
9. Moore, C.J., "The Role of Shear Layer Instability Waves in Jet Exhaust Noise," *J. Fluid Mech.*, **80**, p 321 (1977).
10. Crighton, D.G., "Acoustics as a Branch of Fluid Mechanics," *J. Fluid Mech.*, **106**, p 261 (1981).
11. Long, D.F. and Arndt, R.E.A., "Jet Noise at Low Reynolds Number," *AIAA J.*, **22**, p 187 (1984).
12. Lighthill, M.J., "On Sound Generated Aerodynamically: II. Turbulence as a Source of Sound," *Proc. Royal Soc. London, Ser. A*, **222**, p 1 (1954).

13. Kibens, V., "Discrete Noise Spectrum Generated by an Acoustically Excited Jet," AIAA J., 18, p 343 (1980).
14. Long, D.F., Kim, H.J., and Arndt, R.E.A., "Controlled Suppression or Amplification of Turbulent Jet Noise," AIAA J., 23, p 828 (1985).
15. Lush, P.A., "Measurements of Subsonic Jet Noise and Comparison with Theory," J. Fluid Mech., 46, p 477 (1971).
16. Ahuja, K.K. and Bushell, K.W., "An Experimental Study of Subsonic Jet Noise and Comparison with Theory," J. Sound Vib., 30, p 325 (1973).
17. Lighthill, M.J., "On Sound Generated Aerodynamically: I. General Theory," Proc. Royal Soc. London, Ser. A, 211, p 564 (1952).
18. Chandrusda, C., Mehta, R.D., Weir, A.D., and Bradshaw, P., "Effect of Free-stream Turbulence on Large Structure in Turbulent Mixing Layers," J. Fluid Mech., 82, p 693 (1978).
19. Wagnanski, I., Oster, D., Fiedler, H., and Dziomba, B., "On the Persistence of Quasi Two-Dimensional Eddy-Structure in a Turbulent Mixing Layer," J. Fluid Mech., 93, p 325 (1979).
20. Lumley, J.L., Stochastic Tools in Turbulence, Academic Press (1970).
21. Loeve, M., Probability Theory II, 4th Edition, Springer-Verlag (1978).
22. Rice, S.O., "Mathematical Analysis of Random Noise," Bell System Tech. J., Vols. 23 and 24; also in Noise and Stochastic Processes, Dover (1954), N. Wax (ed).
23. Long, D.F. and Arndt, R.E.A., "The Orthogonal Decomposition of Pressure Fluctuations Surrounding a Turbulent Jet," 5th Symp. Turbulent Shear Flows (Aug 1985).
24. Bakewell, H., "The Viscous Sublayer and Adjacent Wall Region in Turbulent Pipe Flow," Ph.D. Thesis, Pennsylvania State University (1966).
25. Payne, F.R., "Large Eddy Structure of a Turbulent Wake," Ph.D. Thesis, Pennsylvania State University (1966).
26. Ffowcs-Williams, J.E. and Kempton, A.J., "The Noise from the Large Scale Structure of a Jet," J. Fluid Mech., 84, p 673 (1978).
27. Gatski, T.B. and Liu, J.T.C., "On the Interactions between Large-Scale Structure and Fine-Grained Turbulence in a Free Shear Flow; III: A Numerical Solution," Phil. Trans. Royal Soc., London, 293, p 473 (1980).
28. Long, D.F., "Viscous and Compressibility Effects on the Orderly Structure in Turbulent Jets," Ph.D. Thesis, University of Minnesota. In preparation.
29. Johnson, D.H., "The Application of Spectral Estimation Methods to Bearing Estimation Problem," IEEE Proc., 70 (9), p 1018 (1982).
30. Blake, W.K. and Chase, D.M., "Wave Number-Frequency Spectra of Turbulent Boundary Layer Pressure Measured by Microphone Arrays," J. Acoust. Soc. Amer., 42, p 862 (1971).
31. Wakefield, G.H. and Kaveh, M., "Frequency-Wave Number Spectral Estimation of Non Planar Random Fields," Proc. Int. Conf. Acoust., Speech, Signal Processing, Paper No. 21.5 (1985).
32. Chase, D.M., "Modeling the Wave Vector Frequency Spectrum of Turbulent Boundary Layer Wall Pressure," J. Sound Vib., 70, p 29 (1980).

BOOK REVIEWS

TWO PHASE FLOW AND WATERHAMMER LOADS IN VESSELS, PIPING AND STRUCTURAL SYSTEMS

F.J. Moody, Ed.
ASME, PVP-Vol. 91, New York, NY
1984, 102 pages, H00305

This book is a collection of nine papers that were presented at the 1984 Pressure Vessels and Piping Conference and Exhibition, June 17-24, 1984, at San Antonio, Texas.

The papers are a cohesive presentation of the latest development in the analytical treatment of shock flow, waterhammer, and jet flow. The papers address the treatment of shock and waterhammer problems arising in the design of nuclear or conventional power plant piping systems. The majority of papers were written by individuals directly connected to power company engineering staffs.

The nine papers are:

"A Method for Waterhammer Analysis of Control Rod Drive Piping," G.C. Mok

"The Effect of Compressible Pipe Lining on Waterhammer Wave Velocity," R.A. Uffer

"The Effect of Encroachments on Structure Impact Loads during a Pool Swell Transient," E.J. McNamara

"A Methodology for Calculating a Check Valve Closure Following a Postulated Line Break," J.C. Rommel, S.A. Traiforos, and J.H. Bell

"A Procedure for Predicting Temperature Loadings for Thermal Stress Calculations in Thick-Walled Pipes," B.T. Amos and F.J. Moody

"Calculation of Waterhammer Load Resulting from Rapid Steam Bubble Condensation," A. Attia and S. Ruhl

"Modeling Two-Phase Jet Flow," E. Elias, J.M. Healy, A. Singh, and F.J. Moody

"The Prediction of the Strength of Weak to Moderately Strong Shock Waves in Two-Phase Fluids," A.H. Wiedermann

"An Approximate Solution of Steamhammer Using Real Gas Properties," D. Katze and G. Ernest

The book is well edited and has only a few obvious typographical errors. The editor is to be commended for a brief introduction at the beginning of the book; it includes a preparatory recommended reading list for "entry level or established workers" in the field. This is a helpful approach to the reader. The book is recommended for anyone concerned with shock and waterhammer piping problems.

K.E. Hofer
L.J. Broutman & Assoc. Ltd.
Consulting and Testing Services
3424 S. State St.
Chicago, IL 60616

PIPING ENGINEERING TODAY: INNOVATIVE SOLUTIONS THROUGH ANALYSIS, TESTING, AND EXPERIENCE

E.V. Stijgeren, Ed.
ASME, PVP-Vol. 90, New York, NY
1984, 162 pages, H00304

This book is a collection of 16 papers that were presented at the 1984 Pressure Vessels and Piping Conference and Exhibitions on June 17-21, 1984, at San Antonio, Texas. It was sponsored by the pressure vessels and piping division of ASME.

Three of the papers deal with seismic analysis. The paper by Zalak et al has absolutely nothing to do with piping; rather, it treats missile isolation during seismic ground motion. About half the papers present innovative piping components; the other half present computer analytical processes for various piping problems. Three papers treat snubber concepts and analyses. Five papers deal with analysis and testing of piping supports, trays, or hangers. The 16 papers are:

"Generic Design and Qualification of Non-Seismic Category B31.1 Tubing," T.M. Adams and D. Merkovsky

"Generic Design and Qualification of Seismic Category Tube Tray Structures for the Support of B31.1 Instrumentation Tubing," D. Merkovsky and T.M. Adams

"Design Considerations for Supporting Uninsulated Cryogenic Piping," J.J. Pothanikat and A.O. Medellin

"Sodium-Water Reaction Piping Structural Analysis Validation Using Test Results," M.R. Schrag

"Development and Plant Specific Applications of Pressurizer Safety Valve Discharge Loadings," L.C. Smith and K.C. Chang

"Instability Analysis of Piping System," M.Z. Lee and T.S. Jan

"Piping Analysis Computer Program Evaluation," M.Z. Lee

"Design Problems in Modular Construction," S.C. Lou

"Fatigue Failure of Piping Equipment Caused by Flow-Induced Vibrations," A. Shulemovich

"APAD: Preprocessing Program for Pipe Anchor Reinforcement Pad Analysis," T.F. Trimble and T.J. Kim

"Seismic Interference Criteria for Power, Petrochemical and Process Plants," V.M. Zalak and R. Sankar

"Constant Supports -- How Constant?" E.C. Goodling and R.A. DeLoskey

"Snubber Lockup Velocity by Extension of the Response Spectra Method," R.J. Gurdal, W.D. Mazham, and M.K. Punatar

"Response Sensitivity of Piping Systems to Large Lock Up Velocities in Hydraulic Snubbers," M.A. Pickett and S.K. Sinha

"Testing of Welded, Two-Directional Pipe Straps," C.N. Rentschler

"Parametric Studies on the Load-Deflection Characteristics of Hydraulic Snubbers," M. Subudhi, J. Curreri, P. Bezler, and M. Hartzman

Most of the papers are readable. A variety of writing styles and skills are illustrated. The audience addressed by the papers does not appear to have cohesive interests because testing, analysis, mathematics, and design are addressed. The book will be of major interest to piping designers and engineering firm libraries.

K.E. Hofer
L.J. Broutman & Assoc. Ltd.
Consulting and Testing Services
3424 S. State St.
Chicago, IL 60616

THE DYNAMICS OF PRECISE TAPE DRIVES

K. Ragulskis, P. Varanaukas, V. Lelinas,
R. Bentkus, and A. Andriuskevicius
Leidykla Mokslas, Vilnius, USSR
1984 (In Russian)

The material in this book is based on work conducted by the authors in the time period between 1970 and 1980 at the scientific research division -- Vibrotechnica -- of Kaunas Polytechnic Institute. Dynamic analysis models of tape drives, effective methods for the determination of natural frequencies, and primary forms of vibration are described. Questions on the dynamics of basic nodes are examined. The dynamic precision of tape drives when subjected to accidental disturbances is estimated. Methods and synthesis algorithms on frequency spectra are presented, as are methods on dynamic diagnosis.

The first chapter is introductory and includes basic concepts and characteristics of tape drives. Subtopics are: rheological model of a tape drive, dynamic model of tape drives, linearized dynamic model of tape drives, free vibrations of conservative systems, normal coordinates, and free vibrations with damping.

The second chapter presents theory and new mechanisms, the separate links of which, while performing their primary work functions, also have the function of vibroprotection for other links and parts of the system. Sources of disturbance for mechanical vibrations of a working flexible link include various moving masses of the system (pass-by, inertial, and guide rollers), as well as external sources of disturbance. The last factor is especially manifest in on-board mechanical systems of ships. The influence of such disturbances can be avoided by adapting flexible loop-like links. Loops formed by a moving tape damp its mechanical vibrations, which are then transferred to the working parts. This chapter examines practical working models and presents an algorithm for the optimization of mechanisms with free loops. A dynamic model is formulated that considers nodes of rotation created by the moving tape and the damping of angular oscillations.

The third chapter contains an analysis of engineering methods on the synthesis of tape drives based on frequency spectra. The authors use matrix algebra to develop criteria and algorithms for the synthesis of various tape drives: chainlike, branched, bandlike, having group symmetry or quasi-symmetry, and also varying in time parameters. Methods and synthesis algorithms presented can be used for the construction of tape drives taking into account any prohibited zone of frequency interval.

The fourth chapter is devoted to synthesis methods on frequency spectra of tape drives for both conservative and dissipative systems. The fifth chapter contains fairly detailed methods for the dynamic diagnosis of tape drives. Signals containing diagnostic information are examined. Some diagnostic parameters are selected; the precision of their determination is estimated. Atten-

tion is focused on the subject of selecting diagnostic information.

The sixth chapter deals with the dynamic precision of recorders. Together with useful signals this precision registers additional random noise that represents the sum of the nonrandom function and stationary random process. Included are formulas for different probabilistic characteristics of recording loss, sound reproduction, and recording of sound reproduction. A method is developed for the separation of concealed periodics and statistical analysis of random noise.

The book offers a sound introduction to the dynamics of tape drives. Each of the subject areas considered by the authors is presented in a clear and concise manner. The book raises important questions, defines its own assumptions and attempts to offer solutions. Readers who are interested in tape drive dynamics and who read Russian will find this volume a welcome addition to their library.

A. Longinow
Wiss, Janney, Elstner Assoc., Inc.
330 Pfingsten Rd.
Northbrook, IL 60062

MECHANICS AND DESIGN OF CAM MECHANISMS

F.Y. Chen
Pergamon Press, Inc., Elmsford, NY
1982, 523 pages

The value of a reference book is often difficult to assess from a cursory reading or a brief period of intensive study. Its true value is probably best measured by the position it maintains on the engineer's bookshelf and by how often it is used in day-to-day work. In this respect, Professor Chen's book is a success. To those engineers interested in cam design, this book will be a welcome compilation of material previously unavailable in a single source.

Chapter 1 is an introduction to cam mechanisms. It includes a comparison with linkages, as well as cam classification,

nomenclature, and design considerations. According to the author, the remaining 16 chapters are divided into the following four subject areas:

I. Kinematics. Chapters 2 through 8 cover basic cam motion curves, polynomial curves, combined motion curves, and numerical techniques for creating and modifying cam motion curves. Also under this heading is Chapter 9, which covers graphical and analytical methods for determining cam profile coordinates and cutter coordinates.

II. Static Force Analysis. Under this heading are Chapter 10 on force transmission and Chapter 13 on static force and torque calculations.

III. Dynamics. This heading includes Chapter 14 on modeling, Chapter 15 on formulation and solution of the differential equations of motion, and Chapter 16 on dynamic response of typical cam and follower systems.

IV. Design. This is somewhat of a catch-all heading. It includes Chapter 11, cam radius of curvature; Chapter 12, contact stress and wear; and Chapter 17, computer-aided design and optimization of cam mechanisms.

In addition, there are two appendices. The first is a tabulation of factors that simplify the calculation of displacement, velocity, and acceleration for several common cam curves. The second appendix provides a listing of 11 FORTRAN computer programs developed from material in the text.

Generally, the book is easy to read, the figures are clear, and the methods presented are well-illustrated by way of example problems. Unfortunately, however, there are no end-of-the-chapter homework problems for students. Portions of the text are suitable for a graduate-level course in cam design, but the teacher of such a course should select the material carefully and be prepared to supply his own homework problems.

This review would be incomplete without relating the sad and difficult circumstances under which the book was published. Professor Fan Y. Chen died in December, 1981, after a very brief illness. He was, at that time, in the midst of a final proofreading of the text. His wife, Chi-fang, and their two daughters completed the proofreading and saw the book through to publication. As a result, errors remain in the final printing that perhaps would have been corrected had Professor Chen lived. It is to the credit of the publishers that, when these errors came to their attention after the final printing, they sought the aid of technical advisors in completing an errata that has been printed and bound with the book.

This book is a complete, up-to-date reference that should be valuable to both practicing design engineers and to teachers of kinematics and mechanical design.

C. Reinholtz
Assistant Professor
Department of Mechanical Engineering
Virginia Polytechnic Institute
and State University
Blacksburg, VA 24061

SHORT COURSES

JANUARY

SHAFT CRACK DETECTION

Dates: January 14-16, 1986

Place: Atlanta, Georgia

Dates: January 28-30, 1986

Place: Chicago, Illinois

Dates: February 18-20, 1986

Place: Anaheim, California

Objective: The seminar will cover a number of subjects, including vibration measurement transducer applications, filters for shaft crack detection, data presentation formats, rotor mode shape identification, shaft crack documentation, on-line crack detection method, and transient crack detection method. Case histories will be presented on shaft crack detection on a vertical pump, radial cracking on a turbine generator shaft, spiral cracking on a turbine generator shaft, detection of a shaft crack on a boiler feed pump, and laboratory testing results on shaft crack detection. Workshops on mode shape identification, shaft crack detection, and effects of shaft cracks on balancing will also be featured.

Contact: Bently Rotor Dynamics Research Corp., P.O. Box 157, Minden, NV 89423 -800-227-5514, Ext. 9682.

FEBRUARY

VIBRATION AND SHOCK SURVIVABILITY, TESTING, MEASUREMENT, ANALYSIS, AND CALIBRATION

Dates: February 3-7, 1986

Place: Santa Barbara, California

Dates: March 10-14, 1986

Place: Washington, DC

Dates: May 12-16, 1986

Place: Detroit, Michigan

Dates: June 2-6, 1986

Place: Santa Barbara, California

Dates: August 18-22, 1986

Place: Santa Barbara, California

Objective: Topics to be covered are resonance and fragility phenomena, and environmental vibration and shock measurement and analysis; also vibration and shock environmental testing to prove survivability. This course will concentrate upon equipments and techniques, rather than upon mathematics and theory.

Contact: Wayne Tustin, 22 East Los Olivos Street, Santa Barbara, CA 93105 -(805) 682-7171.

MACHINERY MONITORING

Dates: February 11-13, 1986

Place: Houston, Texas

Dates: February 25-27, 1986

Place: Tampa, Florida

Dates: April 22-24, 1986

Place: Philadelphia, Pennsylvania

Dates: May 20-22, 1986

Place: Chicago, Illinois

Dates: June 10-12, 1986

Place: Anaheim, California

Objective: The seminar focuses on the principles of vibration measurement for rotating machinery monitoring. Subjects covered in the seminar include troubleshooting, calibration and maintenance of monitoring systems, and the applications and installation of displacement, velocity, and acceleration transducers.

Contact: Bently Nevada's Customer Information Center, P.O. Box 157, Minden, NV 89437 - 800-227-5514, Ext. 9682.

MACHINERY VIBRATION ANALYSIS I

Dates: February 11-14, 1986

Place: Orlando, Florida

Dates: August 19-22, 1986

Place: New Orleans, Louisiana

Dates: November 11-14, 1986

Place: Chicago, Illinois

Objective: This course emphasizes the role of vibrations in mechanical equipment instrumentation for vibration measurement, techniques for vibration analysis and control, and vibration correction and criteria. Examples and case histories from actual vibration problems in the petroleum, process, chemical, power, paper, and pharmaceutical industries are used to illustrate techniques. Participants have the opportunity to become familiar with these techniques during the workshops. Lecture topics include: spectrum, time domain, modal, and orbital analysis; determination of natural frequency, resonance, and critical speed; vibration analysis of specific mechanical components, equipment, and equipment trains; identification of machine forces and frequencies; basic rotor dynamics including fluid-film bearing characteristics, instabilities, and response to mass unbalance; vibration correction including balancing; vibration control including isolation and damping of installed equipment; selection and use of instrumentation; equipment evaluation techniques; shop testing; and plant predictive and preventive maintenance. This course will be of interest to plant engineers and technicians who must identify and correct faults in machinery.

Contact: Dr. Ronald L. Eshleman, Director, The Vibration Institute, 101 West 55th Street, Suite 206, Clarendon Hills, IL 60514 - (312) 654-2254.

DYNAMIC BALANCING

Dates: February 19-20, 1986
April 23-24, 1986
June 18-19, 1986

Place: Columbus, Ohio

Objective: Balancing experts will contribute a series of lectures on field balancing and balancing machines. Subjects include: field balancing methods; single, two and multi-plane balancing techniques; balancing tolerances and correction methods. The latest in-place balancing techniques will be demonstrated and used in the workshops. Balancing machines equipped with microprocessor instrumentation will also be demonstrated in the workshop sessions, where each student will be involved in hands-on problem-solving using actual armatures, pump impellers, turbine wheels,

etc., with emphasis on reducing costs and improving quality in balancing operations.

Contact: R.E. Ellis, IRD Mechanical Analysis Inc., 6150 Huntley Road, Columbus, OH 43229 - (614) 885-5376.

MARCH

MEASUREMENT SYSTEMS ENGINEERING

Dates: March 10-14, 1986

Place: Phoenix, Arizona

MEASUREMENT SYSTEMS DYNAMICS

Dates: March 17-21, 1986

Place: Phoenix, Arizona

Objective: Electrical measurements of mechanical and thermal quantities are presented through the new and unique "Unified Approach to the Engineering of Measurement Systems." Test requestors, designers, theoretical analysts, managers and experimental groups are the audience for which these programs have been designed. Cost-effective, valid data in the field and in the laboratory, are emphasized. Not only how to do that job, but how to tell when it's been done right.

Contact: Peter K. Stein, Director, 5602 East Monte Rosa, Phoenix, AZ 85018 - (602) 945-4603; (602) 947-6333.

MACHINERY DIAGNOSTICS

Dates: March 11-14, 1986

Place: San Francisco, California

Dates: March 17-21, 1986

Place: Carson City, Nevada

Dates: April 8-11, 1986

Place: Atlanta, Georgia

Dates: May 5-9, 1986

Place: Carson City, Nevada

Dates: June 16-20, 1986

Place: Carson City, Nevada

Dates: June 24-27, 1986

Place: Denver, Colorado

Objective: This seminar instructs rotating machinery users on transducer fundamentals, the use of basic diagnostic techniques, and interpreting industry-accepted vibration data formats to diagnose common rotating machinery malfunctions.

The seminar includes class demonstrations, case histories, and a hands-on workshop that allows participants to diagnose malfunctions on demonstrator rotor systems.

Contact: Bently Nevada's Customer Information Center, P.O. Box 157, Minden, NV 89437 - 800-227-5514, Ext. 9682.

APRIL

ROTATING MACHINERY VIBRATIONS

Dates: April 14-16, 1986

Place: Orlando, Florida

Objective: This course provides participants with an understanding of the principles and practices of rotating machinery vibrations and the application of these principles to practical problems. Some of the topics to be discussed are: theory of applied vibration engineering applied to rotating machinery; vibrational stresses and component fatigue; engineering instrumentation measurements; test data acquisition and diagnosis; fundamentals of rotor dynamics theory; bearing static and dynamic properties; system analysis; blading analysis; life estimation; practical rotor blading-bearing dynamics examples and case histories; rotor balancing theory; balancing of rotors in bearings; rotor signature analysis and diagnosis; and rotor-bearing failure prevention.

Contact: Dr. Ronald L. Eshleman, Director, The Vibration Institute, 101 West 55th Street, Suite 206, Clarendon Hills, IL 60514 - (312) 654-2254.

APPLIED VIBRATION ENGINEERING

Dates: April 14-16, 1986

Place: Orlando, Florida

Objective: This intensive course is designed for specialists, engineers and scientists involved with design against vibration or solving of existing vibration problems. This course provides participants with an understanding of the principles of vibration and the application of these principles to practical problems of vibration reduction or isolation. Some of the topics to be discussed are: fundamentals of

vibration engineering; component vibration stresses and fatigue; instrumentation and measurement engineering; test data acquisition and diagnosis; applied spectrum analysis techniques; spectral analysis techniques for preventive maintenance; signal analysis for machinery diagnostics; random vibrations and processes; spectral density functions; modal analysis using graphic CRT display; damping and stiffness techniques for vibration control; sensor techniques for machinery diagnostics; transient response concepts and test procedures; field application of modal analysis for large systems; several sessions on case histories in vibration engineering; applied vibration engineering state-of-the-art.

Contact: Dr. Ronald L. Eshleman, Director, The Vibration Institute, 101 West 55th Street, Suite 206, Clarendon Hills, IL 60514 - (312) 654-2254.

MACHINERY VIBRATION ANALYSIS II

Dates: April 28 - May 2, 1986

Place: Syria, Virginia

Objective: The objective of this course is to expose participants to advanced techniques of vibration analysis using single- and dual-channel FFT analyzers. These techniques include analysis of spectrum, time, frequency, and orbital domain; modal analysis; coherence, frequency response functions, and synchronous time averaging; and amplitude, phase, and frequency modulation. Data processing procedures are reviewed. All techniques are illustrated with examples and case histories of industrial machinery. Instrumentation necessary to implement the techniques is available for use by participants during informal workshops; taped data from actual industrial machinery are used during these workshops.

Contact: Dr. Ronald L. Eshleman, Director, The Vibration Institute, 101 West 55th Street, Suite 206, Clarendon Hills, IL 60514 - (312) 654-2254.

JULY

ROTOR DYNAMICS

Dates: July 14-18, 1986

Place: Rindge, New Hampshire

Objective: The role of rotor/bearing technology in the design, development and diagnostics of industrial machinery will be elaborated. The fundamentals of rotor dynamics; fluid-film bearings; and measurement, analytical, and computational techniques will be presented. The computation and measurement of critical speeds vibration response, and stability of rotor/bearing systems will be discussed in detail. Finite elements and transfer matrix modeling will be related to computation on mainframe computers, minicomputers, and microprocessors. Modeling and computation of transient rotor behavior and nonlinear fluid-film bearing behavior will be described. Sessions will be devoted to flexible rotor balancing including turbogenerator rotors, bow behavior, squeeze-film dampers for turbomachinery, advanced concepts in troubleshooting and instrumentation, and case histories involving the power and petrochemical industries.

Contact: Dr. Ronald L. Eshleman, Director, The Vibration Institute, 101 West 55th Street, Suite 206, Clarendon Hills, IL 60514 - (312) 654-2254.

AUGUST

VIBRATIONS OF RECIPROCATING MACHINERY

Dates: August 19-22, 1986
Place: New Orleans, Louisiana
Objective: This course on vibrations of reciprocating machinery includes piping and foundations. Equipment that will be addressed includes reciprocating compressors and pumps as well as engines of all types. Engineering problems will be discussed from the point of view of computation and measurement. Basic pulsation theory --including pulsations in reciprocating compressors and

piping systems -- will be described. Acoustic resonance phenomena and digital acoustic simulation in piping will be reviewed. Calculations of piping vibration and stress will be illustrated with examples and case histories. Torsional vibrations of systems containing engines and pumps, compressors, and generators, including gearboxes and fluid drives, will be covered. Factors that should be considered during the design and analysis of foundations for engines and compressors will be discussed. Practical aspects of the vibrations of reciprocating machinery will be emphasized. Case histories and examples will be presented to illustrate techniques.

Contact: Dr. Ronald L. Eshleman, Director, The Vibration Institute, 101 West 55th Street, Suite 206, Clarendon Hills, IL 60514 - (312) 654-2254.

SEPTEMBER

MODAL TESTING OF MACHINES AND STRUCTURES

Dates: September 8-11, 1986
Place: Chicago, Illinois
Objective: Vibration testing and analysis associated with machines and structures will be discussed in detail. Practical examples will be given to illustrate important concepts. Theory and test philosophy of modal techniques, methods for mobility measurements, methods for analyzing mobility data, mathematical modeling from mobility data, and applications of modal test results will be presented.

Contact: Dr. Ronald L. Eshleman, Director, The Vibration Institute, 101 West 55th Street, Suite 206, Clarendon Hills, IL 60514 - (312) 654-2254.

ABSTRACTS FROM THE CURRENT LITERATURE

ABSTRACT CONTENTS

MECHANICAL SYSTEMS	26	Membranes, Films, and Webs..	59
Rotating Machines.....	26	Panels.....	60
Reciprocating Machines.....	28	Plates.....	60
Power Transmission Systems..	29	Shells.....	64
Metal Working and Forming...	29	Pipes and Tubes.....	65
Materials Handling		DYNAMIC ENVIRONMENT	66
Equipment.....	30	Acoustic Excitation.....	66
STRUCTURAL SYSTEMS	30	Shock Excitation.....	67
Bridges.....	30	Vibration Excitation.....	68
Construction Equipment.....	30	MECHANICAL PROPERTIES	69
Off-shore Structures.....	31	Damping.....	69
VEHICLE SYSTEMS	31	Fatigue.....	71
Ground Vehicles.....	31	EXPERIMENTATION	72
Aircraft.....	39	Measurement and Analysis....	72
Missiles and Spacecraft....	43	Dynamic Tests.....	74
BIOLOGICAL SYSTEMS	50	Diagnostics.....	75
Human.....	50	Monitoring.....	75
MECHANICAL COMPONENTS	51	ANALYSIS AND DESIGN	76
Absorbers and Isolators....	51	Analytical Methods.....	76
Tires and Wheels.....	53	Modeling Techniques.....	78
Blades.....	53	Parameter Identification....	78
Bearings.....	55	Design Techniques.....	78
Belts.....	55	Computer Programs.....	79
Fasteners.....	56	GENERAL TOPICS	79
Linkages.....	57	Conference Proceedings.....	79
Valves.....	57	Criteria, Standards, and	
STRUCTURAL COMPONENTS	57	Specifications.....	79
Cables.....	57	Useful Applications.....	80
Beams.....	58		

AVAILABILITY OF PUBLICATIONS ABSTRACTED

None of the publications are available at SVIC or at the Vibration Institute, except those generated by either organization.

Periodical articles, society papers, and papers presented at conferences may be obtained at the Engineering Societies Library, 345 East 47th Street, New York, NY 10017; or Library of Congress, Washington, D.C., when not available in local or company libraries.

Government reports may be purchased from National Technical Information Service, Springfield, VA 22161. They are identified at the end of bibliographic citation by an NTIS order number with prefixes such as AD, N, NTIS, PB, DE, NUREG, DOE, and ERATL.

Ph.D. dissertations are identified by a DA order number and are available from University Microfilms International, Dissertation Copies, P.O. Box 1764, Ann Arbor, MI 48108.

U.S. patents and patent applications may be ordered by patent or patent application number from Commissioner of Patents, Washington, D.C. 20231.

Chinese publications, identified by a CSTA order number, are available in Chinese or English translation from International Information Service, Ltd., P.O. Box 24683, ABD Post Office, Hong Kong.

Institution of Mechanical Engineers publications are available in U.S.: SAE Customer Service, Dept. 676, 400 Commonwealth Drive, Warrendale, PA 15096, by quoting the SAE-MEP number.

When ordering, the pertinent order number should always be included, not the DIGEST abstract number.

A List of Periodicals Scanned is published in issues, 1, 6, and 12.

MECHANICAL SYSTEMS

ROTATING MACHINES

85-2407

Vibration of a Motor on Viscoelastic Foundation Due to Whirling of the Shaft with Consideration of Electromagnetic Forces

K. Nagaya, S. Ikeda
Gunma Univ., Kiryu, Gunma 376, Japan
J. Vib., Acoust., Stress Rel. Des., Trans. ASME, 107 (3), pp 310-318 (July 1985, 12 figs, 5 refs

KEY WORDS: Shafts, Viscoelastic foundations, Whirling, Electromagnetic excitation

This paper discusses bending vibration characteristics of a rotating shaft of a motor with consideration of the electromagnetic sucking force which acts on a rotor caused by the narrow electromagnetic field between a stator and the rotor. The dynamic response of the motor under the action of the whirling load of the shaft has been analyzed systematically by considering both the translational and rotary motions of the motor. In the analysis the transfer matrix method is used to obtain the response of the shaft. Numerical calculations have been carried out for the natural frequencies, the response of the motor shaft, and the response and the transmissibility of the motor.

85-2408

On the Free and Forced Torsional Vibration of Multi-Disk Shaft Systems

L.A. Bergman, J.W. Nicholson
University of Illinois, Urbana-Champaign, IL
Structures, Structural Dynamics and Materials Conf., Proc. of 26th, held April 15-17, 1985, Orlando, FL, spons. AIAA/ASME/ASCE/AHS, Part 2, pp 515-521, 3 figs, 2 tables, 11 refs

KEY WORDS: Shafts, Torsional vibration, Damped structures

A method to analyze the free and forced torsional vibration of viscously damped circular cylindrical shafting carrying a multiplicity of viscously damped linear oscillators and/or rigidly attached disks. The resulting solution is exact when the system is proportionally damped, and approximate otherwise due to truncation.

85-2409

The Effect of Aerodynamic and Structural Detuning on Turbomachine Supersonic Unstalled Torsional Flutter

D. Hoyniak, S. Fleeter
NASA Lewis Res. Ctr., Cleveland, OH
Structures, Structural Dynamics and Materials Conf., Proc. of 26th, held April 15-17, 1985, Orlando, FL, spons. AIAA/ASME/ASCE/AHS, Part 2, pp 500-514, 20 figs, 1 table, 11 refs

KEY WORDS: Rotors, Flutter, Torsional vibration, Fluid-induced excitation, Turbomachinery

A mathematical model is developed to predict the unstalled torsion flutter of an aerodynamically and structurally detuned rotor operating in a supersonic inlet flow field with a subsonic leading edge locus. Stet detuning is considered. The aerodynamic detuning is accomplished by alternating the circumferential spacing of adjacent rotor blades. To demonstrate the effects of aerodynamic and structural detuning on supersonic unstalled torsional flutter, a twelve bladed rotor based on Verdon's Cascade B flow geometry is considered.

85-2410

Instability of Rotors Mounted in Fluid Film Bearings with a Negative Cross-Coupled Stiffness Coefficient

J.S. Rao
Indian Inst. of Technology, New Delhi-110016, India
Mech. Mach. Theory, 20 (3), pp 181-187 (1985), 5 figs, 2 tables, 14 refs

KEY WORDS: Rotors, Fluid-film bearings, Stiffness coefficients, Unbalanced mass response

This paper is concerned with the instability of a rotor mounted in fluid film bearings that can occur when one of the cross-coupled stiffness coefficients of the bearing is negative. It has been shown that this instability occurs in a narrow zone of speed at 2 Xrev frequency. In practice, this can be an important consideration for rotors with asymmetry such as generator rotors.

85-2411

Measurements of Wake-Generated Unsteadiness in the Rotor Passages of Axial Flow Turbines

H.P. Hodson

Cambridge Univ., Cambridge, UK

J. Engrg. Gas Turbines Power, Trans. ASME, 107 (2), pp 467-476 (Apr 1985), 17 figs, 3 tables, 26 refs

KEY WORDS: Rotors, Stalling, Rotor-stator interaction, Fluid-induced excitation

This paper describes an investigation into the free-stream unsteadiness which is found in the rotor passages of axial flow turbines and which is caused by the interaction of the stator wakes with the rotor blades. The major part of this investigation was conducted at the midspan of the rotor of a large-scale, single-stage air turbine.

85-2412

A Theoretical Model for Rotating Stall in the Vaneless Diffuser of a Centrifugal Compressor

P. Frigne, R. Van den Braembussche

CERAC, CH-1024, Ecublens, Switzerland

J. Engrg. Gas Turbines Power, Trans. ASME, 107 (2), pp 507-513 (Apr 1985), 10 figs, 20 refs

KEY WORDS: Centrifugal compressors, Stalling

A theoretical model for rotating stall in the vaneless diffuser of a centrifugal compressor is presented. It consists of a time-evolution calculation of the strong interaction between the inviscid flow core and the unsteady boundary layers along the walls.

It is shown that, depending on the diffuser geometry and the diffuser inlet flow angle, a transient perturbation of the outlet static pressure will generate a rotating flow pattern.

85-2413

Rotating Stall Induced in Vaneless Diffusers of Very Low Specific Speed Centrifugal Blowers

Y. Kinoshita, Y. Senoo

Kyushu Univ., Fukuoka 816, Japan

J. Engrg. Gas Turbines Power, Trans. ASME, 107 (2), pp 514-521 (Apr 1985), 10 figs, 13 refs

KEY WORDS: Blowers, Stalling

The limit of rotating stall was experimentally determined for three very small specific centrifugal blowers. The impellers were specially designed for stall-free at very small flow rates, so that the cause of rotating stall could be attributed to the vaneless diffusers. Experimental results demonstrated that the blowers did not stall until the flow coefficient was reduced to very small values, which had never been reported in the literature.

85-2414

Radial and Tangential Flow Fans -- An Alternative to Axial Flow Fans For Low Noise Automotive Cooling Systems

R.V. Hofe, G.E. Thien

AVL List Ges.m.b.H., Graz, Austria

Surface Vehicle Noise and Vibration Conf. Proc., Traverse City, MI, May 15-17, 1985. Spons. Society of Automotive Engrs., Warrendale, PA, pp 221-230, 11 figs, 14 refs

KEY WORDS: Fans, Cooling systems, Motor vehicles, Noise reduction

Investigations have been carried out into the suitability of radial flow fans as a replacement for axial flow fans. Project objectives were to reduce cooling system noise without increasing bulk volume or impairing efficiency. These considerations apply

particularly to vehicles with engines of high output.

85-2415

Aerodynamically Excited Vibrations of a Part-Span Shrouded Fan

A.V. Srinivasan, D.G. Cutts
United Technologies Res. Ctr., East Hartford, CT 06108
J. Engrg. Gas Turbines Power, Trans. ASME, 107 (2), pp 399-407 (Apr 1985), 17 figs, 7 refs

KEY WORDS: Fans, Shrouds, Aerodynamic loads, Tuning, Vibration measurement

The structural response of a part-span shrouded fan due to an aerodynamic excitation was measured using strain gages. The excitation was provided by means of a 4-lobed distortion screen mounted upstream of the rotor. Vibration measurements made with tuned and mistuned conditions at integral order speeds have been analyzed to determine the aeromechanical response characteristics of the assembly. The results from the experimental investigation are presented and discussed.

85-2416

Investigation of Flow Phenomena in a Transonic Fan Rotor Using Laser Anemometry

A.J. Strazisar
NASA Lewis Res. Ctr., Cleveland, OH 44135
J. Engrg. Gas Turbines Power, Trans. ASME, 107 (2), pp 427-435 (Apr 1985), 10 figs, 2 tables, 15 refs

KEY WORDS: Fans, Shock response, Lasers, Fluid-induced excitation

Several flow phenomena, including flow field periodicity, rotor shock oscillation, and rotor shock system geometry have been investigated in a transonic low aspect ratio fan rotor using laser anemometry. Flow periodicity is found to increase with increasing rotor pressure rise and to correlate with blade geometry variations.

RECIPROCATING MACHINES

85-2417

Combustion Noise from High Speed Direct Injection Diesel Engines

M.F. Russell, R. Haworth
Lucas Industries Noise Centre, Lucas CAV Limited, Acton, London
Surface Vehicle Noise and Vibration Conf. Proc., Traverse City, MI, May 15-17, 1985. Spons. Society Automotive Engrs., Warrendale, PA, pp 95-116, 27 figs, 1 table, 13 refs

KEY WORDS: Diesel engines, Engine noise, Combustion noise, Noise measurement

A simple technique has been developed for measuring the noise radiated by diesel engine surfaces in response to combustion excitation. Results using this technique correlate well with the established computer-based analysis technique.

85-2418

Characteristics of Exciting Forces and Structural Response of Turbocharged Diesel Engines

T. Priede, J.M. Baker, E.C. Grover, R. Ghazy
Southampton Univ., Southampton, UK
Surface Vehicle Noise and Vibration Conf. Proc., Traverse City, MI, May 15-17, 1985. Spons. Society of Automotive Engrs., Warrendale, PA, pp 85-93, 18 figs, 3 refs

KEY WORDS: Diesel engines, Bearings, Time domain method, Frequency domain method

The paper quantifies the forces applied to the main bearings of three six-cylinder turbocharged diesel engines and reviews their exciting properties in both time and frequency domains. The engine structure response at the bearing supports and the outer engine surfaces are correlated. It is shown that the engine structure response is a transient phenomenon and is a maximum in the vicinity of the applied force.

85-2419

Recent Advances in Diesel Engine Research

P.E. Waters

P.E. Waters & Associates

Surface Vehicle Noise and Vibration Conf. Proc., Traverse City, MI, May 15-17, 1985. Spons. Society of Automotive Engrs., Warrendale, PA, pp 345-358, 11 figs, 61 refs

KEY WORDS: Diesel engines, Noise reduction

This paper reviews some recent research in diesel engineering that points the way to possible solutions to the problems facing engine designers in the next 10 to 20 years. These problems are: the need for improved thermal efficiency an multifuel capability to deal with future supplies of fuel for transport and the need to make the engine more socially acceptable by reducing its noise and air pollutant emissions.

85-2420

Engine Structure Analysis for Low Noise -- The Options

M.D. Croker

Ricardo Consulting Engineers

Surface Vehicle Noise and Vibration Conf. Proc., Traverse City, MI, May 15-17, 1985. Spons. Society of Automotive Engrs., Warrendale, PA, pp 75-83, 20 figs, 22 refs

KEY WORDS: Reciprocating engines, Engine noise, Noise reduction

Within the limitations of the combustion process the engine structure remains the key to reducing radiated noise levels. This paper reviews the various techniques available for engine structure analysis in the context of the ever increasing computational power available to the design engineer.

POWER TRANSMISSION SYSTEMS

85-2421

Interactive Computer Simulation of Drivetrain Dynamics

M.C. Tsangarides, W.E. Tobler, C.R. Heermann

Ford Motor Co.

Surface Vehicle Noise and Vibration Conf. Proc., Traverse City, MI, May 15-17, 1985. Spons. Society of Automotive Engrs., Warrendale, PA, pp 143-158, 17 figs, 25 refs

KEY WORDS: Driveline vibrations, Computerized simulation, Torsional response

Computer simulations of vehicle dynamics can be a useful investigative tool in driveability. As the present work demonstrates, oscillations of the drivetrain under steady-state and transient conditions are amenable to mathematical analysis, especially in the torsional mode. Simulations of such a system with a lock-up torque converter are shown with emphasis on tip-in response, transmissibility of engine firing pulsations and self-excited oscillations.. In particular, the method of interactive simulation is shown to be an effective design-aid tool in the investigation of drivetrain vibrations.

85-2422

Research on Idling Rattle of Manual Transmission

S. Ohnuma, S. Yahata, M. Inagawa, T. Fujimoto

Mitsubishi Motors Corp., Tokyo, Japan

Surface Vehicle Noise and Vibration Conf. Proc., Traverse City, MI, May 15-17, 1985. Spons. Society of Automotive Engrs., Warrendale, PA, pp 159-167, 21 figs, 13 refs

KEY WORDS: Power transmission systems, Gear boxes, Torsional vibrations, Diesel engines

Generation mechanism and characteristics of idling rattle are systematized analytically by experiments on vehicle and digital simulation of nonlinear torsional vibration system for an inline four-cylinder four-cycle diesel engine.

METAL WORKING AND FORMING

85-2423

Dynamic Characteristics of Lathe Using Concrete Bed

I.S. Chung, M. Tsutsumi, Y. Ito
Jeonbug National Univ., Jeonju, Korea
Bull. JSME, 28 (239), pp 987-993 (May
1985), 17 figs, 4 refs

KEY WORDS: Lathes, Damping materials,
Concrete

This paper describes the dynamic characteristics of a lathe using a concrete bed. The concrete has attracted special interest as a structural material for its low cost of production and good damping properties. The effects of the concrete bed on the vibration and noise levels of the structure and the dynamic stiffness of a work-spindle system are mainly investigated.

MATERIALS HANDLING EQUIPMENT

85-2424
Forces in the Hoisting Wire of a Crane Barge in Waves
Zu Deyao
Harbin Shipbuilding Engrg. Inst., China
Ocean Engrg., 12 (1), pp 1-16 (1985), 4
figs, 10 tables, 6 refs

KEY WORDS: Cranes (hoists), Barges

In this report a description is given of a method by which the influence can be determined of the dynamic motions of a derrick barge and of the object to be hoisted on the forces in the hoisting wire. The results of these calculations are used for an optimization study in which several parameters of the hoisting system have been varied.

STRUCTURAL SYSTEMS

BRIDGES

85-2425
Three-Dimensional Response of a Concrete Bridge System to Traveling Seismic Waves

B. Dendrou, S. Werner, T. Toridis
George Washington Univ., Washington, DC
Computers Struc., 20 (1-3), pp 593-603
(1985), 8 figs, 3 tables, 21 refs

KEY WORDS: Bridges, Reinforced concrete,
Seismic response, Substructuring methods,
Computer programs

To enhance the evaluation of the bridge response to seismic excitations there is a need to incorporate more parameters in an analytical model. This paper describes a methodology for analysis of traveling seismic wave effects on the dynamic response of an elastic concrete bridge. A substructuring approach is used to efficiently model the bridge/soil dynamic interaction.

85-2426
Dynamic Theory of Trains Passing Through a Railway Bridge - A Study of Effects of the Masses and Inertia Forces of Moving Load
Ye Kaiyuan, Ma Guolin
SSA, 22 (8), pp 831-846 (1984), CSTA No.
625.1-84.28

KEY WORDS: Railroad bridges, Moving
loads, Bridge-vehicle interaction

This paper uses analytic method to investigate the dynamic calculation of the whole process of trains passing through a railway bridge and considers effects of the mass and the damping effect of the bridge as well as the masses of moving loads.

CONSTRUCTION EQUIPMENT

85-2427
In-Place-Dynamic Sound Power Test Method
W.H. Flint
Caterpillar Tractor Co.
Surface Vehicle Noise and Vibration Conf.
Proc., Traverse City, MI, May 15-17, 1985.
Spons. Society of Automotive Engrs., War-
rendale, PA, pp 277-282, 7 figs, 1 table, 3
refs

KEY WORDS: Construction equipment, Sound measurement, Measurement techniques

ISO and SAE static sound power test methods are currently used for construction machinery. The European Economic Community sound committee has been developing a drive-by or simulated work cycle test method using a hemispherical array microphones. The EEC method is inconsistent due to the changing test surface (moist sand) and the variables of outdoor testing: temperature, wind, and precipitation. The in-place-dynamic test method described provides a disciplined way to evaluate machines with moving track or wheels and operating hydraulic systems.

OFF-SHORE STRUCTURES

85-2428

Approximative Formulae for Calculating the Motions of Semi-Submersibles

J.A. van Santen

Marine Structure Consultants, 3370 AC Hardinxveld-Giessendam, The Netherlands
Ocean Engrg., 12 (3), pp 235-252 (1985), 10 figs, 6 refs

KEY WORDS: Submersed structures, Heaving, Off-shore structures

This paper discusses approximative methods to be used in the determination of the heave motions of semi-submersibles. These methods can be useful in the design stage as they circumvent the use of large computer programs.

85-2429

Resonant Heave Motion of Semisubmersible Vessels

C.L. Kirk

Cranfield Inst. of Technology, Cranfield, Bedford MK43 0AL, UK
Ocean Engrg., 12 (2), pp 177-184 (1985), 2 figs, 12 refs

KEY WORDS: Submersed structures, Heaving, Offshore structures

This paper is concerned with nonlinear resonant heave motion of a semisubmersible vessel at the survival draft. Due to the small potential damping of the hulls at deep draft the resonant motion is governed almost entirely by nonlinear drag forces on the hull and bracing members.

VEHICLE SYSTEMS

GROUND VEHICLES

85-2430

Vehicle Sound Measurement — 20 Years of Testing

T. M. Howell, R. F. Schumacher

Ford Motor Company

Surface Vehicle Noise and Vibration Conf. Proc., Traverse City, MI, May 15-17, 1985. Spons. Society of Automotive Engrs., Warrendale, PA, pp 61-73, 5 figs, 2 tables, 38 refs

KEY WORDS: Ground vehicles, Noise measurement, Measurement techniques

Various SAE vehicle noise test subcommittees have been involved in numerous programs to improve and expand the applicability of procedures for increasing exterior noise levels and their relationship to the ever changing product lines. Parallel to this work, governmental and trade associations have also sought changes to better reflect the true measure of noise impact on the community. The evolution of testing has resulted in a continuing improvement in the quality of the test data.

85-2431

Development of an Interior Sound Level Measurement Procedure for Light Vehicles — SAE J1477

K.S. Bagga, E.P. Repick
American Motors Corporation, Detroit, MI
Surface Vehicle Noise and Vibration Conf.
Proc., Traverse City, MI, May 15-17, 1985.
Spons. Society of Automotive Engrs., War-
rendale, PA, pp 293-302, 2 figs, 2 tables, 4
refs

KEY WORDS: Ground vehicles, Motor
vehicles, Interior noise, Noise measurement,
Measurement techniques

With increase emphasis on comparing inter-
ior noise performance levels of passenger
cars, multi-purpose vehicles, and light
trucks, a need existed for the establishment
of a recommended practice for making
interior sound level measurements. Many
variables, such as environmental conditions,
instrumentation and vehicle test parameters
exist that make accurate comparisons of
vehicle interior sound levels difficult at
best. The new proposed SAE Recommended
Practice J1477-XXX8X, Measurement of
Interior Sound Levels of Light Vehicles,
establishes a procedure for making vehicle
interior sound level measurements. Envi-
ronmental conditions, instrumentation set up
and analysis, and vehicle test conditions are
described in detail.

85-2432
**Component Mode Synthesis of a Vehicle
Structural-Acoustic System Model**
S.H. Sung, D.J. Nefke
General Motors Research Laboratories,
Warren, MI
Structures, Structural Dynamics and Materi-
als Conf., Proc. of 26th, held April 15-17,
1985, Orlando, Florida, spons. AIAA/
ASME/ASCE/AHS, Part 2, pp 628-635, 8
figs, 25 refs

KEY WORDS: Component mode synthesis,
Automobiles, Interior noise, Noise predic-
tion, Design techniques

Application of the component mode synthe-
sis technique to develop an analytical struc-
tural-acoustic system model of an
automotive vehicle is described. The system
model combines an acoustic finite element
model of the automobile passenger compart-
ment cavity with finite element and modal

models of the vehicle structural system. The
model can be solved for frequency, ran-
dom, and transient response to predict the
low-frequency interior noise which occurs
during actual operating conditions of the
vehicle. The theoretical formulation of the
model is described, as well as an experi-
mental verification for random input.

85-2433
**An Application of Structural-Acoustic
Analysis to Car Body Structure**
H. Yashiro, K.-i. Suzuki, Y. Kajio, I.
Hagiwara
Nissan Motor Co., Ltd.
Surface Vehicle Noise and Vibration Conf.
Proc., Traverse City, MI, May 15-17, 1985.
Spons. Society of Automotive Engrs., War-
rendale, PA, pp 337-344, 17 figs, 8 refs

KEY WORDS: Automobiles, Interior noise,
Building block approach

In order to calculate efficiently the charac-
teristics of car body vibration and the
acoustic characteristics of the passenger-
compartment, a structural-acoustic analysis
system, CAD-B, was developed. This system
divides the body into three components --
front body, main cabin and rear body. The
characteristics of front and rear body
vibration are expressed in modal paramet-
ters.

85-2434
**A Study of Vehicle Interior Noise Using
Statistical Energy Analysis**
R.G. DeJong
Cambridge Collaborative, Inc., Cambridge,
MA
Surface Vehicle Noise and Vibration Conf.
Proc., Traverse City, MI, May 15-17, 1985.
Spons. Society of Automotive Engrs., War-
rendale, PA, pp 1-6, 12 figs, 7 refs

KEY WORDS: Motor vehicles, Interior
noise, Statistical energy methods

The noise vibration of an automotive vehi-
cle is studied using statistical energy analy-
sis (SEA). Three sources of interior noise

-- the engine, tires, and air flow -- have been measured and used as inputs to the SEA model. The flow of acoustic energy through various structural components is calculated in order to determine the dominant paths of noise transmission to the passenger compartment. The predicted interior noise levels are compared to those measured under different operating conditions.

85-2435

A Study of Noise in Vehicle Passenger Compartment during Acceleration

K. Tsuge, K. Kanamaru, T. Kido, N. Masuda

Toyota Motor Corp.

Surface Vehicle Noise and Vibration Conf. Proc., Traverse City, MI, May 15-17, 1985. Spons. Society of Automotive Engrs., Warrendale, PA, pp 27-34, 16 figs, 4 tables, 1 ref

KEY WORDS: Automobiles, Interior noise, Engine noise

A discomforting noise (rumbling) sometimes heard in a vehicle passenger compartment during acceleration is investigated. A detailed study of the rumbling noise spectrum clarified the generating mechanism of the rumbling noise and the relation between the spectral structure and the tone. In order to analyze the rumbling noise it was simulated with electrically synthesized noise. This method showed that at times when the noise is heard there are more than three discrete harmonics which are half an order harmonics of the engine revolution. The sensation of discomfort depends on the phase, frequency and magnitude of each frequency component.

85-2436

A Review of Parameters Affecting the Noise and Vibration in Diesel Powered Passenger Cars

E. Winklhofer, G.E. Thien

AVL List Ges.m.b.H., Graz, Austria

Surface Vehicle Noise and Vibration Conf. Proc., Traverse City, MI, May 15-17, 1985.

Spons. Society of Automotive Engrs., Warrendale, PA, pp 35-43, 17 figs, 1 table, 9 refs

KEY WORDS: Automobiles, Diesel engines, Interior noise

The noise and vibration properties of diesel engines call for increased efforts in manufacturing passenger cars to achieve a level of comfort comparable to gasoline cars. Starting with measurements of vehicle interior noise reasonable limits of diesel engine noise and vibration levels and sound and vibration transmission properties are defined.

85-2437

Engine Encapsulation on 6-10 Ton-Trucks

M. Stiglmaier, H.-J. Drewitz

M.A.N.

Surface Vehicle Noise and Vibration Conf. Proc., Traverse City, MI, May 15-17, 1985. Spons. Society of Automotive Engrs., Warrendale, PA, pp 117-122, 11 figs

KEY WORDS: Trucks, Traffic noise, Engine noise, Noise reduction

A noise-reducing capsule for distribution trucks with 6 to 10 tons g.v.w. (class 3 to class 6) has been developed. This capsule reduces the drive-past noise by approximately 6 dB(A) and at the same time reduces the noise level in the cab by approximately 3 dB(A). All component temperatures remain inside the permissible ranges; the functionality of vehicles with capsules is retained in full. The dead weight of the trucks is increased by approximately 40 kg.

85-2438

Quiet Heavy Vehicles for 1990 -- The QHV 90 Programme

C.G.B. Mitchell

Transport and Road Research Laboratory, Crowthorne, Berkshire, England

Surface Vehicle Noise and Vibration Conf. Proc., Traverse City, MI, May 15-17, 1985. Spons. Society of Automotive Engrs., War-

rendale, PA, pp 195-202, 2 figs, 4 tables, 20 refs

KEY WORDS: Trucks, Noise reduction

The British Government has set up a program of research and support for development to assist the manufacturers of heavy goods vehicles and their engines to develop products that will comply with new noise limits and be available for production by 1990. The program called QHV 90 is described.

85-2439

Vehicle Response to Throttle Tip-In/Tip-Out
R.A. Krenz
Ford Motor Company
Surface Vehicle Noise and Vibration Conf. Proc., Traverse City, MI, May 15-17, 1985. Spons. Society of Automotive Engrs., Warrendale, PA, pp 45-51, 6 figs, 1 table, 3 refs

KEY WORDS: Automobiles, Transient response

Throttle tip-in/tip-out maneuvers generate a driveline torque transient which may produce an objectionable disturbance to vehicle occupants. Recent developments in vehicle design have contributed to increased severity in this response, which is known as clunk and shuffle. Experimental procedures which have been developed to quantify response levels and diagnose cases of concern are described. Specific design and calibration modifications, which control clunk and shuffle, are also described.

85-2440

Fatigue Analysis of Ground Vehicle Components
R.W. Landgraf
Ford Motor Company, Dearborn, MI
Vehicle Structures, Intl. Conf., Institution of Mech.E., London, Conf. Pub. 1984-7, SAE-MEP 200, pp 101-108, 8 figs, 2 tables, 17 refs

KEY WORDS: Ground vehicles, Fatigue life, Computer programs

Recent advances in material and structural fatigue methodology are reviewed in the context of their applicability to ground vehicle design. The construction and utilization of a package of interactive computer program modules that enable the formulation and solution of a wide variety of ground vehicle fatigue problems is also described. Examples are presented to demonstrate the use of such a tool at various stages of the product development and validation cycle.

85-2441

Fatigue Life Distribution of Vehicle Frame Structures
M. Matolcsy, C. Molnar
Research Institute of Automobile Industry, Autokut, Budapest, Hungary
Vehicle Structures, Intl. Conf., Institution of Mech.E., London, Conf. Pub. 1984-7, SAE-MEP 200, pp 121-130, 9 figs, 8 refs

KEY WORDS: Ground vehicles, Structural members, Fatigue life, Crack propagation

A theoretical description is given of the life distributions in the case of stochastically loaded vehicle structural elements. This method is based on the extreme stress distribution from one side, and on the service strength distribution from the other side. The service strength is derived from the crack propagation functions as well as from the residual strength of cracked structural elements.

85-2442

Fatigue Design of PM Automotive Components
C.M. Sonsino, W.J. Huppmann
Fraunhofer-Institut für Betriebsfestigkeit (LBF), Darmstadt, W. Germany
Intl. J. Vehicle Des., 6 (3), pp 297-310 (May 1985) 11 figs, 3 tables, 15 refs

KEY WORDS: Automobiles, Fatigue life, Design techniques

Among several competing mass-production methods powder metallurgy plays an impor-

tant role not only as a material and energy saving alternative, but also as a technique delivering materials with good fatigue properties. The power metallurgical component design procedure is illustrated by two examples: a conventionally sintered turbocharger bushing and a powder forged parking gear. Both parts were previously designed using conventional wrought steels.

85-2443

Laboratory Methods for Evaluating Car Body Structure-Dynamics and Durability Performance

B. Singh

Austin Rover Group Limited, Oxford
Vehicle Structures, Intl. Conf., Institution of Mech.E., London, Conf. Pub. 1984-7, SAE-MEP 200, pp 115-120, 5 figs, 5 refs

KEY WORDS: Automobiles, Testing techniques, Fatigue tests

Laboratory based test techniques and equipment used for evaluating car body structure dynamics and fatigue performance are discussed.

85-2444

Modelling Problems in the Dynamic Design of Autobuses

P. Michelberger, A. Keresztes, S. Horvath
The Technical Univ. of Budapest, Hungary
Vehicle Structures, Intl. Conf., Inst. of Mech.E., London, Conf. Pub. 1984-7, SAE-MEP 200, pp 195-200, 3 figs, 7 refs

KEY WORDS: Buses, Fatigue life

The complete stress statistics of bus structures require a linearity analysis of the vehicle to establish exact and approximate ranges of computation results. In coefficient matrices of motion equations the rather significant effects of the payload have to be considered separately.

85-2445

Dynamics and Design

F.D. Hales

Univ. of Technology, Loughborough, UK
Intl. J. Vehicle Des., 6 (3), pp 257-262
(May 1985)

KEY WORDS: Motor vehicles, Design techniques

The relationship between the study of dynamics and design of vehicles is discussed. A conflict exists at present as the numerical data for dynamic analysis is often not available until late in the design process, at a stage when design flexibility may have become limited. It is proposed here that in the future there will be more linkage between dynamic studies and computer aided design, with a trend towards engineers who have the ability to teach computers not only to draw but also what to draw.

85-2446

Computer Aided Concept Design of a Sports Car Chassis System

D.J. Fothergill, R. Southall, E. Osmond
SDRC Engrg. Services Ltd., Hitchin, Hertfordshire, UK
Vehicle Structures, Intl. Conf., Inst. of Mech.E., London, Conf. Pub. 1984-7, SAE-MEP 200, pp 91-99, 8 figs, 3 tables

KEY WORDS: Automobiles, Design techniques, Computer aided techniques

A process is described that was used to design a chassis system for a sports car with a non structural plastic body skin. The main concern was to achieve a design with adequate stiffness to promote good handling and ensure that whole vehicle vibration would be satisfactorily controlled. Simple, cost effective computer modeling was used to predict the stiffness of an initial scheme. The chassis model was developed into a dynamic simulation of the whole vehicle.

85-2447

A New Technique for Field Damage Simulation of Elastically Coupled Structures

J.N. Fletcher, R.E. Jones

Surface Vehicle Noise and Vib. Conf. Proc., Traverse City, MI, May 15-17, 1985. Spons. Society of Automotive Engineers, Warrendale, PA, pp 329-335, 10 figs, 12 refs

KEY WORDS: Off-highway vehicles, Structural members, Damage prediction, Modal analysis

A technique for field durability testing of elastically mounted components of off-road vehicles has been developed which simplifies the replication of field damage on these structures. The procedure combines the techniques of cumulative damage and modal analysis to replace the usual multi-shaker excitation technique with a much simpler physical system. This method allows field damage studies to be performed with less laboratory equipment and setup. Initial work has shown that the method is very effective in predicting field failures in an accelerated laboratory test.

85-2448

An Optimization Method for Crashworthiness Design

Ji Oh Song

General Motors Res. Labs., Warren, MI 48090

Structures, Structural Dynamics and Materials Conf., Proc. of 26th, held Apr 15-17, 1985, Orlando, FL, Spons. AIAA/ASME/ASCE/AHS, Part 1, pp 365-372, 10 figs, 2 tables, 6 refs

KEY WORDS: Optimization, Design techniques, Crashworthiness, Collision research (automotive)

A new optimization capability, which determines the dimensions of the structural components, is developed to minimize the structural mass while meeting given safety criteria. The study uses both the nonlinear spring-mass model and beam models in a hybrid manner such that the optimizer interfaces with the spring-mass model, which in turn interfaces with the beam models to obtain force deformation curves required as input. A scale factor representing the stiffness change of a beam due to its design change is introduced to gener-

ate the approximate force-deformation curve of the beam during optimization.

85-2449

Finite Element Modelling of Vehicle Bodies Using Substructuring Methods

M.D. Austin, G.G. Moore

Austin Rover Group, Oxford, UK

Vehicle Structures, Intl. Conf., Instn. of Mech.E., London, Conf. Pub. 1984-7, SAE-MEP 200, pp 83-89, 6 figs

KEY WORDS: Ground vehicles, Finite element technique, Substructuring methods

Earlier finite element modeling methods treated the entire body structure, or one half if symmetry permitted, as a single model. The need to evaluate structures in greater detail led to complex models which produced large volumes of unmanageable data and were inefficient to run. A substructured approach has been developed which reduced these problems. The method uses commercially available software for model preparation and analysis, together with in-house software for interfacing between a draughting geometry database and the modeling database, and for pre- and post-processing of the analysis files.

85-2450

An On-Board Crash Test Data Acquisition System

S.P.F. Petty

Transport and Road Res. Lab., Crowthorne, Berkshire, UK

Vehicle Structures, Intl. Conf., Instn. Mech.E., London, Conf. Pub. 1984-7, SAE-MEP 200, pp 11-12

KEY WORDS: Collision research (automotive), Testing techniques, Data recorders

Problems in the data acquisition system used when vehicle structures are crash tested has resulted in the formation of a task group to produce a specification for an alternative system. The evolution of the specification from its original simple concept to its final form is described.

85-2451

Trends in the Design of Car Front and Side Structures to Meet Future Safety Needs

I.D. Neilson

Transport and Road Res. Lab., Crowthorne, Berkshire, UK

Vehicle Structures, Intl. Conf., Instn. of Mech.E., London, Conf. Pub. 1984-7, SAE-MEP 200, pp 1-6, 1 table, 11 refs

KEY WORDS: Collision research (automotive), Design techniques

A review of the current situation regarding car occupants and pedestrians injured in road accidents involving cars is presented. The compulsory use of seat belts has transformed the situation and the paper deals with the structural aspects of what should be done next in car design. The discussion suggests how all safety needs may be achieved in one design of front structure.

85-2452

Evaluation of the Structural Integrity of Intermediate Buses

F.F. Monasa

Michigan Technological Univ., Houghton, MI
Vehicle Structures, Intl. Conf., Instn. of Mech.E., London, Conf. Pub. 1984-7, SAE-MEP 200, pp 207-215, 8 figs, 16 refs

KEY WORDS: Buses, Collision research (automotive)

The results obtained from evaluation of the structural integrity, under accident situations, of intermediate buses are presented. A method based on the finite element modeling technique and a nonlinear structural analysis procedure is used. The results for rollover, side impact, and front impact loading conditions are presented graphically as load-deflection diagrams along with the three-dimensional analytical model of the passenger compartment framework showing the sequence of plastic hinge formation, for each loading condition, up to collapse.

85-2453

The Use of the National Highway Traffic

Safety Administration's Vehicle Crash Test Data Base in a Study of Vehicle Structural Responses

J.R. Hackney

National Highway Traffic Safety Admn., Washington, DC

Vehicle Structures, Intl. Conf., Instn. of Mech.E., London, Conf. Pub. 1984-7, SAE-MEP 200, pp 13-20, 6 figs, 3 tables, 4 refs

KEY WORDS: Collision research (automotive), Experimental data

The National Highway Traffic Safety Administration's vehicle crash test data base which contains information on almost 700 vehicles is providing the data for extensive studies of vehicle structural responses. An example of a study shows the significance of vehicle crash pulses to potential occupant injuries.

85-2454

Future Trends in the Simulation of Crashworthiness

G.H. Tidbury

Cranfield Inst. of Technology, Cranfield, Bedford, UK

Vehicle Structures, Intl. Conf., Instn. of Mech.E., London, Conf. Pub. 1984-7, SAE-MEP 200, pp 21-28, 6 figs, 29 refs

KEY WORDS: Collision research (automotive), Crashworthiness

The development of crash simulation is traced for the two main aspects of accident simulation and vehicle design. It is shown that useful information can be obtained on both these aspects by the use of classical mechanics with simplified structural crush parameters. Because of the complication of the complete simulation of the crush behavior of sheet metal structures the method of idealizing the front of a car as a series of masses connected by nonlinear springs generally attributed to Kamal is described.

85-2455

Numerical Calculation of the Bending

Collapse of Two Structural Car Safety Components

T. Scharnhorst

Volkswagenwerk AG, Forschung, Wolfsburg, W. Germany

Vehicle Structures, Intl. Conf., Instn. of Mech.E., London, Conf. Pub. 1984-7, SAE-MEP 200, pp 29-38, 11 figs, 21 refs

KEY WORDS: Collision research (automotive), Finite element techniques, Damage prediction

Nonlinear finite element techniques are applied to a longitudinal car beam and the bending collapse of a steering tube column. Results are compared to measurements and suggest that these numerical techniques can be applied in a predictive manner and that they are useful in reducing the amount of component testing.

85-2456

Modelling the Collapse of Cars in Asymmetrical Barrier Impact Tests

M. Brennan, M. Macaulay, A. Wynn-Ruffhead

University College, London WC1, UK

Vehicle Structures, Intl. Conf., Instn. of Mech.E., London, Conf. Pub. 1984-7, SAE-MEP 200, pp 39-45, 10 figs, 1 table, 4 refs

KEY WORDS: Collision research (automotive), Impact tests, Guardrails

The development and use of a two-dimensional lumped-mass computer model to simulate cars deforming in frontal barrier impact tests is described. The masses are chosen to be representative of two types of car for which impact data were available, and the load-deflection characteristics of the structural members are fitted to the behavior of these two cars in the symmetrical frontal impact test and two different asymmetrical tests. Use is made of operator controlled and automatic optimizing routines.

85-2457

Twisting Collapse of Open Sections

A.M.S. Al-Sheikh, M.A. Nanayakkara, P.W. Sharman

University of Technology, Loughborough, UK
Vehicle Structures, Intl. Conf., Instn. of Mech.E., London, Conf. Pub. 1984-7, SAE-MEP 200, pp 47-51, 9 figs, 7 refs

KEY WORDS: Collision research (automotive), Design techniques, Automobiles, Energy absorption

In the design of cars, and other safety sensitive systems, it is essential that the energy of impact is absorbed in progressively deforming parts of the structure, particularly in regions which are relatively unimportant in terms of the primary purpose. The large deformations experienced by open sections during collapse may be conveniently described by discrete mathematical methods, utilizing finite elements and powerful incremental programs accounting for plasticity as well as the large displacements.

85-2458

Influence of Inertia in Structural Crashworthiness

S.R. Reid, C.D. Austin

Univ. of Aberdeen

Vehicle Structures, Intl. Conf., Instn. of Mech.E., London, Conf. Pub. 1984-7, SAE-MEP 200, pp 63-70, 8 figs, 14 refs

KEY WORDS: Crashworthiness, Structural members, Ground vehicles, Tubes, Energy absorption

The effects of inertia on the modes of collapse of two classes of structure are described and discussed. Systems of structural elements which have a monotonically increasing load-deflection curve deform under the influence of structural waves when subjected to impact loading. The behavior of tubular columns is dominated by the effects of instability which are also strongly influenced by the inertia of the structure.

AIRCRAFT

85-2459

Unsteady Flows Around Three-Dimensional Wings

M. Gad-el-Hak

Flow Research Co., Kent, WA

Rept. No. FRC-RR-305, AFOSR-TR-84-1243, 90 pp (Oct 1, 1984), AD-A149 993-8/GAR

KEY WORDS: Aircraft wings, Fluid-induced excitation

Time-dependent flows around rectangular, swept of delta wings undergoing harmonic pitching motions were investigated using flow visualization techniques. The wings were towed in an 18-m water channel at chord Reynolds numbers up to 350,000. Fluorescent dye layers were excited with a sheet of laser light and used to mark the flow in the separation region around the lifting surface, the wake region and the potential flow away from the wing. The flow field around each wing depends to a large degree on wing planform, leading edge contour, and the reduced frequency of oscillation. The results can be mostly explained in terms of the mutual induction between the leading edge separation vortex and the trailing edge shedding vortex.

85-2460

A New Approach to Durability Prediction for Fuel Tank Skins

M.A. Ferman, W.H. Unger, C.R. Saff, M.D. Richardson

McDonnell Douglas Corp., St. Louis, MO

Structures, Structural Dynamics and Materials Conf., Proc. of 26th, held April 15-17, 1985, Orlando, Florida, spons. AIAA/ASME/ASCE/AHS, Part 2, pp 102-109, 14 figs, 6 refs

KEY WORDS: Fuel tanks, Aircraft components, Fatigue life

A potential source of fuel tank leakage, premature fatigue cracks initiated from a newly recognized dynamic loading, is investigated. This new loading source results

from fluid structure interaction dynamics between tank skins and fuel mass. Significant strain intensifications are produced, and since they occur at higher frequencies, they cause a reduced fatigue life. It is believed that this approach may help to explain why many instances of premature tank skin fatigue and leakage were not previously predicted by maneuver spectrum fatigue methods. This should provide an improved design approach to minimize fuel leakage from fatigue cracks.

85-2461

An Improved Source Model for Aircraft Interior Noise Studies

J.R. Mahan, C.R. Fuller

Virginia Polytechnic Inst. and State Univ., Blacksburg, VA

Structures, Structural Dynamics and Materials Conf., Proc. of 26th, held April 15-17, 1985, Orlando, Florida, spons. AIAA/ASME/ASCE/AHS, Part 2, pp 602-608, 8 figs, 1 table, 6 refs

KEY WORDS: Aircraft noise, Interior noise

The present paper exploits an existing analytical model for noise transmission into aircraft cabins to investigate the behavior of an improved propeller source model for use in aircraft interior noise studies. The new source model, a virtually rotating dipole, is shown to adequately match measured fuselage sound pressure distributions, including the correct phase relationships, for published data. As an example of its application, the virtually rotating dipole is used to study the sensitivity of synchrophasing effectiveness to the fuselage sound pressure trace velocity distribution. Results of calculations are presented.

85-2462

Dynamic Loads Analyses of Flexible Airplanes — New and Existing Techniques

A.S. Pototzky, B. Perry, III

Kentron International, Inc., Hampton, VA

Structures, Structural Dynamics and Materials Conf., Proc. of 26th, held April 15-17, 1985, Orlando, Florida, spons. AIAA/

ASME/ASCE/AHS, Part 2, pp 651-663, 14 figs, 1 table, 19 refs

KEY WORDS: Aircraft, Aerodynamic loads, Mode displacement method, Mode acceleration method, Summation of forces method

Existing techniques for calculating dynamic loads for flexible airplanes are reviewed and a new technique is presented. The new technique involves the summation-of-forces method of writing dynamic loads equations. The new technique uses s-plane approximation methods to transform the dynamic loads equations from a second-order frequency-domain formulation with frequency-dependent coefficients into a linear-time-invariant state-space formulation. Several numerical examples demonstrate the usefulness of the new technique and the high quality of the results.

85-2463

Influence of Warpage on Composite Aeroelastic Theories

G.A. Oyibo, J.H. Berman
Fairchild Republic Co., Farmingdale, NY
Structures, Structural Dynamics and Materials Conf., Proc. of 26th, held April 15-17, 1985, Orlando, Florida, spons. AIAA/-ASME/ASCE/AHS, Part 2, pp 330-336, 4 figs, 14 refs

KEY WORDS: Aircraft wings, Warping, Aeroelasticity

The new methodology used as the basic tool in this paper is basically the aeroelastic equivalent of the aerodynamic similarity rule. The influence of warping (spanwise axial constraints on wing twist) on composite wing aeroelastic oscillations is investigated using this approach. Results show that a high-aspect-ratio composite wing could behave aeroelastically like a low aspect ratio wing and vice-versa. Similarity parameters derived in this analysis expose conditions for which this might happen.

85-2464

A New Approach to Apply the Potential Gradient Method for Supersonic Unsteady Airloads

K. Appa
Northrop Corp., Hawthorne, CA
Structures, Structural Dynamics and Materials Conf., Proc. of 26th, held April 15-17, 1985, Orlando, Florida, spons. AIAA/-ASME/ASCE/AHS, Part 2, pp 50-55, 4 tables, 10 refs

KEY WORDS: Aircraft wings, Aerodynamic loads, Gradient methods

A new approach in applying the potential gradient method to compute the generalized aerodynamic forces on wing-like lifting surfaces is discussed. An aerodynamic influence coefficient formulation relating the downwash and the panel pressure distributions has been derived. The formulation is such that there is no need to consider the wake or the diaphragm elements in the analysis. Since there is no series expansion of the frequency term in this method, computations at low supersonic Mach numbers and high reduced frequencies can be performed with no convergence difficulties.

85-2465

Wing Rock Flow Phenomena

L.E. Ericsson
Lockheed Missiles and Space Co., Inc., Sunnyvale, CA
Proc. of Workshop on Unsteady Separated Flow held at U.S. Air Force Academy, Aug 10-11, 1983, AD-A148 249, pp 10-20, AD-P004 154/1/GAR

KEY WORDS: Aircraft wings, Fluid-induced excitation

Flow mechanisms that can generate wing-rock type oscillations are described. It is shown that the slender wing rock phenomenon, the limit cycle oscillation in roll observed for very slender delta wings, is caused by asymmetric leading edge vortices and that vortex breakdown can never be the cause of it as it has a damping effect.

85-2466

Effect of Active Control System Nonlinearities on the L-1011-3(ACS) Design Gust Loads

J.D. Gould
Lockheed California Co., Burbank, CA
Structures, Structural Dynamics and Materials Conf., Proc. of 26th, held April 15-17, 1985, Orlando, Florida, spons. AIAA/ASME/ASCE/AHS, Part 2, pp 468-476, 22 figs, 2 tables, 4 refs

KEY WORDS: Aircraft Wings, Wind induced excitation, Active control, Design techniques

An active control system has been developed for a derivative of the L-1011 which allows an increase in wing span with little increase in design wing loads. An allowance for load increases produced by active control system nonlinear effects has been included in the design loads, and the adequacy of this allowance has been substantiated by a nonlinear simulation of the aircraft and active control system encountering these severe turbulence levels.

85-2467
The Computation of Second-Order Accurate Unsteady Aerodynamic Generalized Forces
B. van Niekerk

Stanford Univ., Stanford, CA 94305
Structures, Structural Dynamics and Materials Conf., Proc. of 26th, held April 15-17, 1985, Orlando, Florida, spons. AIAA/ASME/ASCE/AHS, Part 2, pp 56-63, 5 figs, 1 table, 18 refs

KEY WORDS: Airfoils, Aircraft wings, Weighted residual technique, Flutter

A classical variational principle is used to derive special properties of a weighted residual method. It is shown that some weighted integral of the sought solution can be obtained to second-order accuracy in the solution to the original and adjoint problems. For aerodynamic problems, it is assumed that the reverse flow problem is adjoint to the original problem. Examples on airfoils and panel methods demonstrate the fast convergence of generalized aerodynamic forces on airfoils and wings.

85-2468
Transonic Test of a Forward Swept Wing Configuration Exhibiting Body Freedom Flutter

R. Chipman, F. Rauch, M. Rimer, B. Muniz
Grumman Aerospace Corp., Bethpage, NY 11714

Structures, Structural Dynamics and Materials Conf., Proc. of 26th, held April 15-17, 1985, Orlando, Florida, spons. AIAA/ASME/ASCE/AHS, Part 2, pp 298-312, 16 figs, 2 tables, 11 refs

KEY WORDS: Aircraft wings, Flutter, Wind tunnel testing

Body freedom flutter is a dynamic instability involving aircraft pitch and wing bending motions which, though rarely experienced on conventional vehicles, is characteristic of forward swept wing (FSW) aircraft. To investigate this aeroelastic phenomenon, tests were conducted on a 1/2-scale, flying, cable-mounted model of a realistic FSW configuration with and without relaxed static stability (RSS).

85-2469
Flutter and Divergence Boundary Prediction from Nonstationary Random Responses at Increasing Flow Speeds

Y. Matsuzaki, Y. Ando
Nagoya Univ., Nagoya, Japan
Structures, Structural Dynamics and Materials Conf., Proc. of 26th, held April 15-17, 1985, Orlando, Florida, spons. AIAA/ASME/ASCE/AHS, Part 2, pp 313-319, 7 figs, 20 refs

KEY WORDS: Aircraft wings, Flutter

A locally stationary process method for predicting the flutter and divergence boundaries is presented. The method was applied to response signals of wing models due to flow turbulence measured in sub-critical flutter and divergence tests, in which the dynamic pressure was increased at a constant speed with the Mach number being fixed.

85-2470
Measured Unsteady Transonic Aerodynamic Characteristics of an Elastic Supercritical Wing with an Oscillating Control Surface

D.A. Seidel, M.C. Sandford, C.V. Eckstrom
NASA Langley Res. Ctr., Hampton, VA
23665

Structures, Structural Dynamics and Materials Conf., Proc. of 26th, held April 15-17, 1985, Orlando, Florida, spons. AIAA/ASME/ASCE/AHS, Part 2, pp 64-71, 13 figs, 10 refs

KEY WORDS: Aircraft wings, Airfoils, Flutter, Wind tunnel tests, Experimental data

Transonic steady and unsteady aerodynamic data were measured on a large elastic wing in a transonic dynamics tunnel. The wing had a supercritical airfoil shape and a leading-edge sweepback of 28.8° . The wing was heavily instrumented to measure both static and dynamic pressures and deflections. A hydraulically driven outboard control surface was oscillated to generate unsteady airloads on the wing. Representative results from the wind tunnel tests are presented and discussed.

85-2471

Coupling Linearized Far-Field Boundary Conditions with Non-Linear Near-Field Solutions in Transonic Flow

W.S. Rowe, F.E. Ehlers
Boeing Commercial Airplane Co., Seattle, WA

Structures, Structural Dynamics and Materials Conf., Proc. of 26th, held April 15-17, 1985, Orlando, Florida, spons. AIAA/ASME/ASCE/AHS, Part 2, pp 72-82, 24 figs, 6 refs

KEY WORDS: Aircraft, Flutter, Fluid induced excitation

A research investigation has been conducted to evaluate the feasibility of coupling linearized far field solutions with near-field finite differencing equations to reduce the size of grid networks required in transonic flow calculations. A criterion based on the gradient of the flow field Mach number was developed for use in establishing the minimum size grid network necessary for accurate finite thickness unsteady loading predictions.

85-2472

Unsteady Transonic Flow Calculations for Two-Dimensional Canard-Wing Configurations with Aeroelastic Applications

J.T. Batina
NASA Langley Res. Ctr., Hampton, VA
Structures, Structural Dynamics and Materials Conf., Proc. of 26th, held April 15-17, 1985, Orlando, Florida, spons. AIAA/ASME/ASCE/AHS, Part 2, pp 1-9, 13 figs, 1 table, 13 refs

KEY WORDS: Aircraft wings, Aerodynamic loads, Fluid-induced excitation, Flutter

Unsteady transonic flow calculations for aerodynamically interfering airfoil configurations are performed as a first step toward solving the three-dimensional canard-wing interaction problem. These calculations are performed by extending the XTRAN2L two-dimensional unsteady transonic small-disturbance code to include an additional airfoil. Unsteady transonic forces due to plunge and pitch motions of a two-dimensional canard and wing are presented.

85-2473

Computer-Aided Frequency Domain Synthesis of a Robust Active Flutter Suppression Control Law

D.K. Schmidt, T.K. Chen
Purdue Univ., West Lafayette, IN
Structures, Structural Dynamics and Materials Conf., Proc. of 26th, held April 15-17, 1985, Orlando, Florida, spons. AIAA/ASME/ASCE/AHS, Part 2, pp 459-467, 7 figs, 3 tables, 18 refs

KEY WORDS: Active flutter control, Frequency domain method, Computer-aided techniques, Graphic methods

Computer-aided graphical conventional synthesis techniques are employed to obtain a robust active-flutter-suppression control law. The relatively high dynamic order of such problems are dealt with effectively with a computer-aided approach, while interactive computer graphics allows conventional graphical techniques to be utilized. Key design information is displayed for variations in flight conditions such that a simple control law is obtained that is

robust over the variation in the flight condition

85-2474

Flutter Control with Unsteady Aerodynamic Models

Shyang Chang

Ph.D. Thesis, Univ. of California, Los Angeles, 106 pp (1984), DA8428493

KEY WORDS: Aircraft, Flutter, Vibration control

This dissertation deals with a generic problem for aircraft: control laws for flutter suppression. Until recently, the system frequency response was approximated by rational functions so that the finite-dimensional L-Q-R theory could be applied. However, discrepancy between theory and practice, especially in the transient response, has led to renewed interest in the problem. A time-domain model for unsteady aerodynamic loads was developed and then coupled with a lumped model for the structural dynamics.

MISSILES AND SPACECRAFT

85-2475

Transient Load Analysis Method for Large Linear Structures with Local Nonlinearities and Its Application to Space Shuttle Payload Load Analysis

M. Kitagawa, K. Kubomura

Rockwell International, Downey, CA 90241 Structures, Structural Dynamics and Materials Conf., Proc. of 26th, held April 15-17, 1985, Orlando, Florida, spon. AIAA/ASME/ASCE/AHS, Part 2, pp 404-416, 11 figs, 16 refs

KEY WORDS: Space shuttle, Transient excitation

The development of a method for a transient load analysis of a large-scale structure with local nonlinearities is described. The results from applying the method to the

Space Shuttle payload dynamic loads analysis are presented. The method was formulated by using the finite difference time integration equation developed from the Duhamel integration and interpolating the nonlinear forces during each time interface. Results of an investigation leading to finding the appropriate nonlinear force time interpolation functions are also presented.

85-2476

A Simpler Approach to Update Spacecraft Launch Loads

B.N. Agrawal, P. Grosserode, J.O. Dow

Intl. Telecommunications Satellite Organization, Washington, DC

Structures, Structural Dynamics and Materials Conf., Proc. of 26th, held April 15-17, 1985, Orlando, Florida, spon. AIAA/ASME/ASCE/AHS, Par 2, pp 417-425, 11 figs, 1 tables, 6 refs

KEY WORDS: Spacecraft, Transient analysis, Launching

A simpler approach is presented to update launch loads for a spacecraft whose structural dynamic characteristics have been modified during its design phase. The spacecraft dynamic characteristics influence the interface acceleration by introducing anti-resonances (notches) at the spacecraft cantilever frequencies. The proposed approach consists of shifting the anti-resonance frequencies in the interface acceleration in accordance with the changes in the natural frequencies of the spacecraft. It provides a significant improvement in the accuracy of the calculated spacecraft launch loads in comparison with the base drive technique.

85-2477

Stability of Flexible Structures with Random Parameters

F. Kozin

Polytechnic Inst. of New York, Brooklyn, NY

Structures, Structural Dynamics and Materials Conf., Proc. of 26th, held April 15-17, 1985, Orlando, Florida, spon. AIAA/-

ASME/ASCE/AHS, Part 2, pp 166-172, 3 figs, 11 refs

KEY WORDS: Spacecraft, Stability, Stochastic processes

A brief description of the problem of stability of stochastic systems, results available for the study of stability of continuous parameter structures, and results needed for design applicability are presented.

85-2478

Use of Helium Gas to Reduce Acoustic Transmission

J.G. Blevins, L.L. Hansen

Martin Marietta Denver Aerospace, New Orleans, LA

Structures, Structural Dynamics and Materials Conf., Proc. of 26th, held April 15-17, 1985, Orlando, Florida, spons. AIAA/-ASME/ASCE/AHS, Part 2, pp 96-101, 10 figs, 1 table

KEY WORDS: Spacecraft components, Sound transmission, Launching response, Acoustically induced excitation

Payload enclosures subjected to high energy acoustical environments may have high transmissibility due to coupling between structural and acoustical modes. Reducing transmissibility by mass attenuation, increased absorption or damping causes undesirable weight increases. It is shown that decoupling of the dynamic modes can be achieved without increasing weight by introducing a different gas (helium (He)) inside the enclosure from the ambient gas (air) outside the enclosure. For a certain frequency range, analytical studies of the external tank aft cargo carrier show nearly zero sound reduction through the structure.

85-2479

Low-Authority Control Synthesis for Large Spacecraft Structures, Using Disturbance Propagation Concepts

A.H. von Flotow

German Space Operations Ctr., DFVLR Oberpfaffenhofen, Wessling, Fed. Republic Germany

Structures, Structural Dynamics and Materials Conf., Proc. of 26th, held April 15-17, 1985, Orlando, Florida, spons. AIAA/-ASME/ASCE/AHS, Part 2, pp 152-160, 12 figs, 23 refs

KEY WORDS: Spacecraft, Active vibration control

This paper introduces the point of view that elastic deformation in large spacecraft structures may be aptly viewed in terms of propagating disturbances. The control concepts which result from such a viewpoint are presented.

85-2480

Integrated Structural/Control Synthesis via Set-Theoretic Methods

A.L. Hale

General Dynamics Convair Div., San Diego, CA

Structures, Structural Dynamics and Materials Conf., Proc. of 26th, held April 15-17, 1985, Orlando, Florida, spons. AIAA/-ASME/ASCE/AHS, Part 2, pp 636-641, 3 tables, 16 refs

KEY WORDS: Spacecraft, Vibration control

An ellipsoidal set-theoretic approach to the integrated structural/control synthesis for vibration regulation of flexible structures such as large space structures is considered. The synthesis attempts to maximize the allowable magnitude of an unknown but bounded disturbance to the structure while explicitly satisfying specific input and output constraints. Both structural parameters and control gains are variable during a search for the maximum allowable disturbance. A simple numerical example is presented to illustrate this synthesis approach.

85-2481

Control of Dynamic Response of a Continuous Model of a Large Space Structure

P.E. O'Donoghue, S.N. Atluri

Georgia Inst. of Technology, Atlanta, GA
Structures, Structural Dynamics and Materi-

als Conf., Proc. of 26th, held April 15-17, 1985, Orlando, Florida, spons. AIAA/-ASME/ASCE/AHS, Part 2, pp 31-42, 14 figs, 3 tables, 23 refs

KEY WORDS: Spacecraft, Vibration control, Equivalent continuum method

The problem of active control of the transient dynamic response of large space structures, modeled as equivalent continua, is investigated. The effects of initial stresses, in the form of in-plane stress resultants in an equivalent plate model, on the controllability of transverse dynamic response, are studied. A singular-solution approach is used to derive a fully coupled set of nodal equations of motion which also include non-proportional passive damping.

85-2482

Direct Computation of Optimal Control of Forced Linear System

S. Utku, Chin-Po Kuo, M. Salama
Duke Univ., Durham, NC 27706

Structures, Structural Dynamics and Materials Conf., Proc. of 26th, held April 15-17, 1985, Orlando, Florida, spons. AIAA/-ASME/ASCE/AHS, Part 2, pp 454-458, 6 refs

KEY WORDS: Spacecraft, Optimum control theory

The optimal control of a forced linear system may be reduced to that of tracking the system without forces. The solution of the tracking problem is available via the co-state variables method. This procedure is computationally expensive for large order systems. It requires solution of matrix Riccati equation and two final value problems. An alternate approach is outlined for the direct computation of the optimal control. A matrix Volterra integral must be solved. For this purpose two computational schemes are described, and an illustrative example is given.

85-2483

Optimal Structural Modifications to Enhance the Optimal Active Vibration Control of Large Flexible Structures

N.S. Khot, F.E. Eastep, V.B. Venkayya
Air Force Wright Aeronautical Labs.,
Wright Patterson Air Force Base, OH 45433
Structures, Structural Dynamics and Materials Conf., Proc. of 26th, held April 15-17, 1985, Orlando, Florida, spons. AIAA/-ASME/ASCE/AHS, Part 2, pp 134-142, 4 figs, 11 tables, 13 refs

KEY WORDS: Spacecraft, Active vibration control, Structural modification techniques, Optimization

This study provides a method of vibration control of large space structures by simultaneously integrating the structure and control design to reduce the structural response from a disturbance encountered. The formulation of the design scheme is obtained by the structural modification of some nominal finite element model, which is controlled in an optimal fashion by a linear regulator, to increase the active modal damping factor beyond that of the nominal structure. The structural modifications are achieved by using a nonlinear mathematical optimization technique.

85-2484

Use of Piezo-Ceramics as Distributed Actuators in Large Space Structures

E.F. Crawley, J. de Luis
Massachusetts Inst. of Technology, Cambridge, MA

Structures, Structural Dynamics and Materials Conf., Proc. of 26th, held April 15-17, 1985, Orlando, Florida, spons. AIAA/-ASME/ASCE/AHS, Part 2, pp 126-133, 8 figs, 1 table, 8 refs

KEY WORDS: Spacecraft, Actuators, Piezoelectricity, Active vibration control

Distributed segmented piezoelectric actuators bonded to an elastic sub-structure in flexure are modelled. A static shear-lag mechanical model for the interface between the piezo-electric and the sub-structure is developed. An example of the integration of the static piezo structure interaction into a simple dynamic model for the beam is given. This model leads to the ability to predict, a priori, the response of the structural member to an excitation voltage applied to the piezo-electric.

85-2485

Inertial Actuator Design for Maximum Passive and Active Energy Dissipation in Flexible Space Structures

D.W. Miller, E.F. Crawley, B.A. Ward
Massachusetts Inst. of Technology, Cambridge, MA

Structures, Structural Dynamics and Materials Conf., Proc. of 26th, held April 15-17, 1985, Orlando, Florida, spon. AIAA/ASME/ASCE/AHS, Part 2, pp 536-544, 10 figs, 3 tables, 8 refs

KEY WORDS: Spacecraft, Active vibration control, Vibration absorbers (equipment)

The selection of the passive parameters for passive and active inertial vibration absorbers intended for use in large flexible space structures is investigated. Optimal passive vibration absorbers are designed for one and two DOF structural representations using three parameter optimization techniques: minimum maximum steady-state response; pole placement; and quadratic cost minimization. The three techniques yield nearly identical results.

85-2486

Sensitivity of Optimized Control Systems to Minor Structural Modifications

R.T. Haftka, Z. N. Martinovic, W.L. Hallauer, Jr., G. Schamel
Virginia Polytechnic Inst. and State Univ., Blacksburg, VA

Structures, Structural Dynamics and Materials Conf., Proc. of 26th, held April 15-17, 1985, Orlando, Florida, spon. AIAA/ASME/ASCE/AHS, Part 2, pp 642-650, 6 figs, 7 tables, 8 refs

KEY WORDS: Structural modification techniques, Vibration control

A procedure for checking whether small changes in a structure have the potential for significant enhancements of its optimized vibration control system is described. The procedure has been demonstrated for a flexible laboratory structure controlled by several rate-feedback collocated force-actuator velocity-sensor pairs. Significant improvements in the performance of the control system were obtained with small structural modifications.

85-2487

A Design Technique for Determining Actuator Gains in Spacecraft Vibration Control

G.C. Horner, J.E. Walz
NASA Langley Res. Ctr., Hampton, VA
Structures, Structural Dynamics and Materials Conf., Proc. of 26th, held April 15-17, 1985, Orlando, Florida, spon. AIAA/ASME/ASCE/AHS, Part 2, pp 143-151, 7 figs, 2 tables, 9 refs

KEY WORDS: Spacecraft, Actuators, Active vibration control, Damping coefficients

A design procedure is described which determines the gains of a diagonal damping matrix to control the vibrations of a flexible structure with application to orbiting spacecraft. The procedure is based on minimizing the energy dissipated by control actuators using nonlinear mathematical programming. A grillage example is used to demonstrate the design process for determining gains for two representative cases. Resulting designs are verified by a finite element analysis of the structure augmented by the control actuators.

85-2488

Damping Synthesis for Flexible Space Structures Using Combined Experimental and Analytical Models

M.L. Soni, B.N. Agrawal
Univ. of Dayton Res. Inst., Dayton, OH
Structures, Structural Dynamics and Materials Conf., Proc. of 26th, held April 15-17, 1985, Orlando, Florida, spon. AIAA/ASME/ASCE/AHS, Part 2, pp 552-558, 2 figs, 3 tables, 5 refs

KEY WORDS: Spacecraft, Damping synthesis, Modal synthesis

A procedure is presented for modal and damping synthesis of flexible space structures from subsystem tests and/or analyses. The results of the developed modal and damping synthesis procedure are verified by using a representative flexible space structure including structural joints.

85-2489

A Comparison of the Craig-Bampton and

Residual Flexibility Methods for Component Substructure Representation

D.C. Kammer, M. Baker
Structural Dynamics Res. Corp., San Diego, CA 92121

Structures, Structural Dynamics and Materials Conf., Proc. of 26th, held April 15-17, 1985, Orlando, Florida, spon. AIAA/-ASME/ASCE/AHS, Part 2, pp 699-706, 5 figs, 1 table, 6 refs

KEY WORDS: Spacecraft, Component mode synthesis

A theoretical and numerical comparison is made between the fixed interface Craig-Bampton method and the free interface methods of MacNeal and Rubin for component substructure representation. The static and dynamic equivalence of the methods is investigated for a restrained substructure. Vector space theory is used to derive a relation which must be satisfied for dynamic equivalence of the Craig-Bampton and Rubin substructure representations.

85-2490

A Cost-Effective Component Modes Analysis for Shuttle Payloads Using a Combination of Frequency Domain and Time Domain Approaches

M. Trubert, L. Peretti
California Inst. of Technology, Pasadena, CA 91109

Structures, Structural Dynamics and Materials Conf., Proc. of 26th, held April 15-17, 1985, Orlando, Florida, spon. AIAA/-ASME/ASCE/AHS, Part 2, pp 391-403, 9 figs, 1 table, 17 refs

KEY WORDS: Space shuttles, Component mode analysis, Modal analysis, Frequency domain method, Time domain method

Rather than using a frequency domain to solve the entire problem, a combination of the time domain and the frequency domain is sought using the frequency domain only for those areas where the time domain is clearly inefficient or uncertain. In the structural analysis of spacecraft launched on a launch vehicle, an intermediate step to arrive at the structural loads in the spacecraft is the determination of the time histo-

ries at the launch vehicle/spacecraft interface (statically determinate or not). The time domain approach is traditionally used to obtain this interface acceleration by merging the launch vehicle and the spacecraft at the modal level. The frequency allows the determination of this new interface acceleration without the need for a new merged system eigenvalue solution and subsequent system modal responses.

85-2491

Effect of Degradation of Material Properties on the Dynamic Response of Large Space Structures

S. Kalyanasundaram, J.D. Lutz, W.E. Haisler, D.H. Allen
Texas A & M Univ., College Station, TX 77843

Structures, Structural Dynamics and Materials Conf., Proc. of 26th, held April 15-17, 1985, Orlando, Florida, spon. AIAA/-ASME/ASCE/AHS, Part 2, pp 545-551, 10 figs, 17 refs

KEY WORDS: Spacecraft, Composite materials, Natural frequencies, Mode shapes

The effect of degradation of material properties on structural frequencies and mode shapes of large space structures (LSS) is investigated. The difficulty and cost of maintenance of LSS make it a necessity to design these structures to operate with a certain amount of load-induced damage. This damage is commonly observed in fibrous composite media.

85-2492

Dynamic Analysis of a Deployable Space Structure

G.E. Weeks
The Univ. of Alabama, Tuscaloosa, AL
Structures, Structural Dynamics and Materials Conf., Proc. of 26th, held April 15-17, 1985, Orlando, Florida, spon. AIAA/-ASME/ASCE/AHS, Part 2, pp 43-49, 12 figs, 14 refs

KEY WORDS: Spacecraft, Expandable structures, Natural frequencies, Mode shapes

A mathematical model and a corresponding simulation code have been developed for investigating the free vibration and forced response behavior of a deployable space structure. It is demonstrated that accurate results for frequency and mode shape characteristics can be obtained with only a small number of generalized coordinates and thus, appears to be a more computationally efficient algorithm than the finite element method.

85-2493

General Motion of Gyroelastic Vehicles in Terms of Constrained Modes

G.M.T. D'Eleuterio, P.C. Hughes

Univ. of Toronto, Downsview, Ontario, Canada

Structures, Structural Dynamics and Materials Conf., Proc. of 26th, held April 15-17, 1985, Orlando, Florida, spons. AIAA/-ASME/ASCE/AHS, Part 2, pp 384-390, 4 figs, 9 refs

KEY WORDS: Spacecraft, Gyroelastic properties, Modal analysis

The dynamical equations for the general motion of gyroelastic vehicles -- vehicles modeled by a continuum of mass, stiffness and gyricity (stored angular momentum) -- are developed. The motion is expanded in terms of the vehicle's corresponding constrained modes. The associated eigenvalue problem reveals a significant departure from the modal behavior of nongyric elastic vehicles.

85-2494

Collaborative Techniques in Modal Analysis

M.L. Amirouche, R.L. Huston

Univ. of Illinois, Chicago, IL

Structures, Structural Dynamics and Materials Conf., Proc. of 26th, held April 15-17, 1985, Orlando, Florida, spons. AIAA/-ASME/ASCE/AHS, Part 2, pp 161-165, 3 figs, 3 tables, 13 refs

KEY WORDS: Spacecraft, Modal analysis, Finite segment method

A new hybrid procedure for determining vibration characteristics of large structures is presented. The procedure combines modal analysis techniques with recently developed techniques of finite-segment modelling. The procedure uses experimental results from modal analysis and scaling procedures to set the parameters for the finite segment model of the structure. Kane's equations are then used to obtain the governing equations of motion.

85-2495

Optimization Using Lattice Plate Finite Elements for Feedback Control of Space Structures

S.E. Lamberson, T.Y. Yang

Purdue Univ., West Lafayette, IN

Structures, Structural Dynamics and Materials Conf., Proc. of 26th, held April 15-17, 1985, Orlando, Florida, spons. AIAA/-ASME/ASCE/AHS, Part 2, pp 743-750, 13 figs, 10 refs

KEY WORDS: Spacecraft, Feedback control, Finite element technique, Optimization

Lattice plate finite elements based on a continuum model of a large plate-like lattice space structure examine the effect of variation of several fundamental structural parameters on the natural frequencies and mode shapes of the structure. Reduced order controller design models are developed using modal cost analysis to rank the modes for each set of structural parameter values.

85-2496

Extension of Ground-Based Testing for Large Space Structures

B.K. Wada, C.P. Kuo, R.J. Glaser

California Inst. of Technology, Pasadena, CA

Structures, Structural Dynamics and Materials Conf., Proc. of 26th, held April 15-17, 1985, Orlando, Florida, spons. AIAA/-ASME/ASCE/AHS, Part 2, pp 477-483, 2 figs, 4 tables, 6 refs

KEY WORDS: Spacecraft, Testing techniques, Boundary condition effects

The results of the multiple boundary conditions test approach, which provides a complete ground test of a large structure that will provide, in turn, the data necessary to construct a test-verified final mathematical model, is presented. Theoretical studies indicate that this approach can provide a better final model than a ground test of the full-scale very flexible structure in a 1-g field.

85-2497

Structural Dynamic Model Reduction Using Worst Case Impulse Response Criteria for Large Flexible Space Structures.

A.S.S.R. Reddy

Howard Univ., Washington, DC

Structures, Structural Dynamics and Materials Conf., Proc. of 26th, held April 15-17, 1985, Orlando, Florida, spons. AIAA/ASME/ASCE/AHS, Part 2, pp 262-265, 1 fig, 1 table, 12 refs

KEY WORDS: Spacecraft, Impulse response, Multidegree of freedom systems, Reduction methods

A situation is presented in which a structure is subject to a finite impulse in all its degrees of freedom, and the participation of the various modal coordinates in dynamic response are evaluated. The dynamic response under an impulse in every degree of freedom is considered as the worst case and the modal coordinate participation is used as a criteria to eliminate some of the modes from the model. A finite element model of hoop/column antenna is considered as an example to demonstrate the reduction procedure.

85-2498

Comparative Analysis of On-Orbit Dynamic Performance of Several Large Antenna Concepts

G.C. Andersen, L.B. Garrett, R.E. Calleson
NASA Langley Res. Ctr., Hampton, VA

Structures, Structural Dynamics and Materials Conf., Proc. of 26th, held April 15-17, 1985, Orlando, Florida, spons. AIAA/ASME/ASCE/AHS, Part 2, pp 707-722, 14 figs, 6 tables, 7 refs

KEY WORDS: Spacecraft antennas, Vibration control

With the increased accessibility to space, the utilization of space as a viable communication and earth observation medium will further develop. Many of these systems will require large space structures to meet the performance specifications. Along with the distinct advantages these structures bring, complex disadvantages also arise due to the inordinate and inherent flexible nature of the structures. Four antenna concepts -- the box truss, tetrahedral truss, wrap-radial rib, and hoop and column antenna are examined to determine the characteristic and magnitudes of the dynamic response in terms of structural displacements and member loads when subjected to various slew rate maneuvers.

85-2499

Dynamic Characteristics of Statically Determinate Space-Truss Platforms

M.S. Anderson, N.A. Nimmo

NASA Langley Res. Ctr., Hampton, VA

Structures, Structural Dynamics and Materials Conf., Proc. of 26th, held April 15-17, 1985, Orlando, Florida, spons. AIAA/ASME/ASCE/AHS, Part 2, pp 723-728, 10 figs, 1 table, 6 refs

KEY WORDS: Spacecraft antennas, Supports, Natural frequencies, Mode shapes

The geometry of a class of statically determinate platforms is developed and vibration frequencies determined. Such configurations would allow shape control by changing member lengths to be accomplished with small forces. An additional advantage of a statically determinate structure is being free of thermal stress under any temperature distribution. Frequency comparisons between statically determinate and more conventional redundant platforms are presented. Vibration of curved platforms that could be used as antenna concepts is also investigated.

85-2500

System and Structural Dynamic Observations of a Slew Box Truss Antenna

E.E. Bachtell, S.S. Bettadapur, L.A. Karanian, W.A. Schartel
Martin Marietta Denver Aerospace, Denver, CO

Structures, Structural Dynamics and Materials Conf., Proc. of 26th, held April 15-17, 1985, Orlando, Florida, spon. AIAA/-ASME/ASCE/AHS, Part 2, pp 735-742, 11 figs, 5 tables

KEY WORDS: Spacecraft antennas, Transient response, Damping effects

A parametric study was performed to define slewing capability of large satellites and associated system changes or subsystem complexity impacts. The satellite configuration and structural arrangement from the earth observation spacecraft study was used as the baseline spacecraft. Varying slew rates, settling times, damping, maneuver frequencies, and attitude hold times provided the data required for application to a wide range of potential missions.

85-2501

Dynamics and Control of a Large Deployable Reflector

G.J. Balas, R. Shepherd
California Inst. of Technology
Structures, Structural Dynamics and Materials Conf., Proc. of 26th, held April 15-17, 1985, Orlando, Florida, spon. AIAA/-ASME/ASCE/AHS, Part 2, pp 729-734, 7 figs, 2 tables, 3 refs

KEY WORDS: Spacecraft antennas, Modal damping

The problem of passively controlling structural deformations in a large deployable reflector by adding damping to the system is reviewed. The results of modeling a large deployable reflector with PATRAN-G and analyzing it with EASE2 and MSC/NASTRAN finite element codes are reported. The first ten asymmetric and symmetric mode shapes and natural frequencies are determined.

BIOLOGICAL SYSTEMS

HUMAN

85-2502

A New Ride Quality Meter

J.J. Wood, J.D. Leatherwood
Wyle Labs.

Surface Vehicle Noise and Vibration Conf. Proc., Traverse City, MI, May 15-17, 1985. Spon. Soc. of Automotive Engrs., Warrendale, PA, pp 177-183, 10 figs, 13 refs

KEY WORDS: Vibration measurement, Noise measurement, Ride dynamics, Human response

An overview of the development of a NASA ride comfort model is presented. A new instrument is described, the ride quality meter, which incorporates the NASA-developed model to characterize ride comfort based upon measurement of vehicle interior noise and vibration. The meter is a portable unit which provides real-time estimates of passenger ride comfort during actual vehicle operations. It provides the first known capability to directly sum the effects of noise and vibration into a single objective comfort index.

85-2503

Some Aspects of Motorcycle Noise and Annoyance

P.M. Nelson
Transport and Road Res. Lab.
Surface Vehicle Noise and Vibration Conf. Proc., Traverse City, MI, May 15-17, 1985. Spon. Soc. of Automotive Engrs., Warrendale, PA, pp 185-194, 11 figs, 16 refs

KEY WORDS: Motorcycles, Traffic noise, Human response

Results of studies carried out at the TRRL on motorcycle noise and annoyance is presented. It is found that motorcycle noise is a disturbing element of traffic noise but, at present, their numbers are too low to affect measured overall traffic noise levels.

85-2504

Statistical Methods for Evaluating Truck Ride Quality Measures

J.R. Strong

Kenworth Truck Co.

Surface Vehicle Noise and Vibration Conf. Proc., Traverse City, MI, May 15-17, 1985. Spons. Soc. of Automotive Engineers, Warrendale, PA, pp 213-220, 12 figs, 9 refs

KEY WORDS: Trucks, Ride dynamics, Human response

Statistical methods were applied to subjective and objective ride measures used for class 8 cab-over-engine trucks. The probability of incorrectly choosing one objective ride measure over another based on its correlation coefficient with jury ratings was investigated using Monte Carlo simulation. An estimate of the standard deviation of objective ride measure error as a function of correlation coefficient was also developed.

85-2505

The Correlation of Objective Ride Measures to Subjective Jury Evaluations of Class 8 COE Vehicles

T.H. Norsworthy

Kenworth Truck Co.

Surface Vehicle Noise and Vibration Conf. Proc., Traverse City, MI, May 15-17, 1985. Spons. Soc. of Automotive Engineers, Warrendale, PA, pp 203-212, 18 figs, 9 refs

KEY WORDS: Trucks, Ride dynamics, Human response

Fifty-six ride tests of class 8 COE vehicles were conducted. Linear correlation was investigated between subjective jury ratings and each of 12 objective ride measures that were calculated from vertical and longitudinal cab acceleration measurements. Ninety-five percent confidence bandwidths and correlation coefficients were used to compare the correlation of each ride measure to the jury ratings.

85-2506

Experimental Determination of the Smallest

Perceivable Changes in Octave Bands of Automobile Interior Noise

J. Bavonese, G.L. Gibian

General Motors Res. Labs., Warren, MI

Surface Vehicle Noise and Vibration Conf. Proc., Traverse City, MI, May 15-17, 1985. Spons. Soc. of Automotive Engineers, Warrendale, PA, pp 169-175, 9 figs, 5 refs

KEY WORDS: Automobiles, Interior noise, Human response

Human response to spectral changes in automobile interior noise, which characteristically has strong low-frequency content and much less high-frequency content, is investigated.

MECHANICAL COMPONENTS

ABSORBERS AND ISOLATORS

85-2507

A Method of Analysis for Unidirectional Vibration Isolators with Many Degrees of Freedom

S.A. Paipetis, A.F. Vakakis

The Univ. of Patras, Patras, Greece

J. Sound Vib., 98 (1), pp 13-23 (Jan 8, 1985), 6 figs, 1 table, 4 refs

KEY WORDS: Vibration isolators, Viscoelastic properties

An analytical procedure for the evaluation of transmissibility of an n-degree-of-freedom viscoelastic antivibration mounting is developed. The method is based on a model consisting of a number of equal masses connected with viscoelastic resilient elements with known properties. The latter can be expressed analytically through suitable rheological models or determined experimentally.

85-2508

Optimum Design of Dynamic Absorber for a

Random-Excited Machine Mounted on a Platelike Structure Foundation

K.S. Wang, Y.Z. Wang, R.T. Wang
National Cheng Kung Univ., Tainan, Taiwan, Rep. of China
Int. J. Mech. Sci., 22 (5), pp 335-344 (1985), 6 figs, 12 refs

KEY WORDS: Dynamic absorbers, Machinery, Random excitation, Optimum design

The optimum design of a dynamic absorber for a machine mounted on a floor system is presented. The floor is considered to be a platelike structure. The transfer function is derived in closed form. Based on the band-limited white-noise excitation, the optimum tuning and damping ratios of the absorber are determined by minimizing the variance of response of the machine. Since the variance cannot be calculated directly by integrating the transfer function over the band-limited frequency range, the steepest descent method is used for determining these optimum parameters by iteration. The same procedure can be extended to deal with the cases of other multi degrees-of-freedom systems.

85-2509

Understanding Hydraulic Mounts for Improved Vehicle Noise, Vibration and Ride Qualities

W.C. Flower
Lord Corp., Erie, PA
Surface Vehicle Noise and Vibration Conf. Proc., Traverse City, MI, May 15-17, 1985. Spons. Soc. of Automotive Engineers, Warrendale, PA, pp 123-132, 9 figs

KEY WORDS: Engine mounts, Hydraulic systems, Ground vehicles, Vibration control, Noise reduction

It is now apparent that properly applied hydraulic mounts can significantly alter the perceived performance of current production automobiles. Benefits such as reduced interior noise and vibration levels, and improved ride, especially on moderate to rough roads, are now attainable. Such improvements require the careful design and application of hydraulic powertrain mounts, utilizing a variety of hydraulic design op-

tions, some or all of which may be appropriate to the specific vehicle application under consideration.

85-2510

An Analysis and Application of a Decoupled Engine Mount System for Idle Isolation

D.M. Ford
Vehicle Concepts Res. Lab., Ford Research Staff, Dearborn, MI
Surface Vehicle Noise and Vibration Conf. Proc., Traverse City, MI, May 15-17, 1985. Spons. Soc. of Automotive Engineers, Warrendale, PA, pp 133-142, 14 figs, 3 refs

KEY WORDS: Engine mounts, Vibration control

The issue of front wheel drive engine idle isolation is addressed. Criteria for design is established and an analysis of an application is presented. The approach was to model the powertrain and engine mounts as a 6 DOF lumped parameter system and decouple the five highest frequency rigid body modes from the direction of the idle torque pulses (crankshaft rotation direction).

85-2511

Desirable Structural Features for the Design of Front and Rear Underrun Bumpers for Heavy Goods Vehicles

S. Penoyre, B.S. Riley, M. Page
Transport and Road Res. Lab., Crowthorne, Berkshire, UK
Vehicle Structures, Intl. Conf., Institution of Mech.E., London, Conf. Pub. 1984-7, SAE-MEP 200, pp 139-145, 3 figs, 6 refs

KEY WORDS: Bumpers, Trucks

A review of accident situations requiring underrun bumpers is presented and the effects of car masses and structural strengths on the design of bumpers is considered. Design features discussed include: height above ground, strength to withstand full, partial offset and angled impacts, travel and force/deflection characteristics of energy absorbing bumpers and soft bumper faces to reduced pedestrian injuries.

85-2512

The Noise of Cross Groove Tire Tread Pattern Elements

L.J. Oswald, A. Arambages
 General Motors Res. Labs., Warren, MI
 Surface Vehicle Noise and Vibration Conf.
 Proc., Traverse City, MI, May 15-17, 1985.
 Spons. Soc. of Automotive Engineers,
 Warrendale, PA, pp 231-255, 17 figs, 9 refs

KEY WORDS: Tires, Trucks, Noise generation

This report deals specifically with the noise mechanisms of cross groove type tread elements, which includes both individual cross groove and cross lug elements. The parameters investigated include groove depth, angle of the groove relative to the sidewall, groove shape, and spacing between grooves.

85-2513

A Dynamic Tire/Soil Contact Surface Interaction Model for Aircraft Ground Operations

W.S. Pi
 Northrop Corp., Hawthorne, CA
 Structures, Structural Dynamics and Materials Conf., Proc. of 26th, held April 15-17, 1985, Orlando, Florida, spons. AIAA/ASME/ASCE/AHS, Part 2, pp 321-329, 7 figs, 2 tables, 6 refs

KEY WORDS: Aircraft tires, Soil tire interaction

A dynamic tire/soil contact surface interaction model for aircraft ground operations is described. The formulation uses a finite element kernel function approach. It is based on the concept of the quasi-steady motion of a tired-wheel rolling at a constant speed on a linear viscoelastic layer (soil). Numerical examples were given to correlate the experimental results from a high flotation test program.

85-2514

Holographic Measurements and Theoretical Predictions of the Unsteady Flow in a Transonic Annular Cascade

M.R.D. Davies, P.J. Bryanston-Cross
 Univ. of Cambridge, Cambridge, UK
 J. Engrg. Gas Turbines Power, Trans. ASME, 107 (2), pp 450-457 (Apr 1985), 18 figs, 15 refs

KEY WORDS: Fan blades, Cascades, Holographic techniques

A series of measurements have been made on a transonic annular cascade. The cascade which represents the tip section of a compressor fan blade has an inlet Mach number of 1.18. By the use of external vibrators it is possible to vibrate the blades independently in torsion simulating different interblade phase angles to gain an understanding of shock movement and blade loading. The results presented are made over interblade phase angles of 180 and 135 deg at a blade frequency parameter of 0.1, based on chord.

85-2515

Optimization and Mechanisms of Mistuning in Cascades

E.F. Crawley, K.C. Hall
 Massachusetts Inst. of Technology, Cambridge, MA
 J. Engrg. Gas Turbines Power, Trans. ASME, 107 (2), pp 418-426 (Apr 1985), 13 figs, 1 table, 19 refs

KEY WORDS: Fan blades, Cascades, Tuning

An inverse design procedure has been developed for the optimum mistuning of a high bypass ratio shroudless fan. The fan is modeled as a cascade of blades, each with a single torsional degree of freedom. Linearized supersonic aerodynamic theory is used to compute the unsteady aerodynamic forces in the influence coefficient form at a typical blade section. The mistuning pattern is then numerically optimized using the method of nonlinear programming via

augmented Lagrangians. The objective of the mistuning is to achieve a specified increase in aeroelastic stability margin with a minimum amount of mistuning.

85-2516

Flutter of Swept Fan Blades

R.E. Kielb, K.R.V. Kaza
NASA Lewis Res. Ctr., Cleveland, OH
J. Engrg. Gas Turbines Power, Trans. ASME, 107 (2), pp 394-398 (Apr 1985), 9 figs, 1 table, 14 refs

KEY WORDS: Fan blades, Flutter, Geometric effects, Aerodynamic loads,

The effect of sweep on fan blade flutter is studied by applying the analytical methods developed for aeroelastic analysis of advanced turboprops. Two methods are used. The first method utilizes an approximate structural model in which the blade is represented by a swept, nonuniform beam. The second method utilizes a finite element technique to conduct modal flutter analysis.

85-2517

Some Recent Advances in the Understanding and Prediction of Turbomachine Subsonic Stall Flutter

R.M. Chi, A.V. Srinivasan
United Technologies Res. Ctr., East Hartford, CT
J. Engrg. Gas Turbines Power, Trans. ASME, 107 (2), pp 408-417 (Apr 1985), 16 figs, 24 refs

KEY WORDS: Rotor blades, Flutter

Some recent advances in the understanding and prediction of subsonic flutter of jet engine fan rotor blades are reviewed. A particular shrouded fan of advanced design is examined in the detailed technical discussion.

85-2518

Propeller Aerodynamic Performance by Vortex-Lattice Method

M. Kobayakawa, H. Onuma
Kyoto Univ., Kyoto, Japan
J. Aircraft, 22 (8), pp 649-654 (Aug 1985), 11 figs, 24 refs

KEY WORDS: Propeller blades, Aerodynamic loads

It is inappropriate to apply classical propeller theories to design an advanced turboprop (ATP). The vortex-lattice method is applied to rotating blades. Other properties characteristics of an ATP; i.e., effect of displacement velocities, interference effect between blades, and effect of flow deflection by a spinner and nacelle, are introduced into the calculations. Powers, thrusts, and efficiencies of two kinds of ATP, SR-1 and SR-3, are obtained and compared with experimental values.

85-2519

Application of the Finite-State Arbitrary-Motion Aerodynamics to Rotor Blade Aeroelastic Response and Stability in Hover and Forward Flight

M.A.H. Dinyavari, P.P. Friedmann
Univ. of California, Los Angeles, CA
Structures, Structural Dynamics and Materials Conf., Proc. of 26th, held April 15-17, 1985, Orlando, Florida, spons. AIAA/-ASME/ASCE/AHS, Part 2, pp 522-535, 16 figs, 16 refs

KEY WORDS: Helicopters, Propeller blades, Aerodynamic loads

The influence of finite-state arbitrary-motion time-domain aerodynamics on rotor blade aeroelastic stability in hover and forward flight is illustrated. The essential ingredients of the generalized Greenberg type time-domain unsteady aerodynamics are presented and incorporated in a coupled nonlinear flap-lag analysis. Aeroelastic stability boundaries for both hover and forward flight are obtained using both arbitrary-motion time-domain aerodynamics and quasisteady aerodynamics.

85-2520

Effects of Mistuning on the Forced Vibration of Bladed Disks in Subsonic Flow

P.W. Whaley, J.C. MacBain
Univ. of Nebraska
Structures, Structural Dynamics and Materials Conf., Proc. of 26th, held April 15-17, 1985, Orlando, Florida, spons. AIAA/-ASME/ASCE/AHS, Part 2, pp 490-499, 16 figs, 1 table, 12 refs

KEY WORDS: Bladed disks, Tuning, Forced vibrations

Forced vibration as a function of mistuning is investigated for aeroelastic coupling and subsonic flow. Under certain aerodynamic conditions and for certain engine orders and mistuning, the forced vibration has been demonstrated to increase by more than an order of magnitude.

BEARINGS

85-2521

An Influence of Fluid Inertia Forces on the Dynamic Characteristics of Tilting-pad Journal Bearings in Turbulent Flow

H. Hashimoto, S. Wada, S. Yamamoto
Tokai Univ., Hiratsuka-shi, Kanagawa, Japan
Bull. JSME, 28 (239), pp 919-923 (May 1985), 7 figs, 4 refs

KEY WORDS: Journal bearings, Tilt pad bearings, Fluid inertia forces, Turbulence

An influence of fluid inertia forces on the dynamic characteristics of tilting-pad journal bearings in turbulent flow is investigated theoretically. Applying the generalized turbulent lubrication equation with inertia effects to the centrally pivoted 2-pads journal bearings, the dynamic oil film forces are obtained.

85-2522

A Refined Numerical Solution for the Hydrodynamic Lubrication of Finite Porous Journal Bearings

B.R. Reason, A.H. Siew
Cranfield Inst. of Technology, Cranfield, Bedford, UK

IMEchE, Proc., 192 (C2), pp 85-93 (1985), 8 figs, 7 refs

KEY WORDS: Journal bearings, Hydrodynamic lubrication

A refined numerical solution for the hydrodynamic performance of finite porous journal bearings is presented. The solution takes into account the curvature of the bearing wall, interfacial slip of the fluid across the pore mouths, and employs the Reynolds boundary conditions at the oil film extremities.

85-2523

On the Radial Vibration of Ball Bearings (Computer Simulation)

S. Fukata, E.H. Gad, T. Kondou, T. Ayabe
Kyushu Univ., 6-10-1 Hakozaki, Higashi-ku, Fukuoka-shi, Japan
Bull. JSME, 28 (239), pp 899-904 (May 1985), 8 figs, 2 tables, 7 refs

KEY WORDS: Ball bearings, Radial vibrations, Computerized simulation

Computer simulation is used to analyze the radial vibration of ball bearings in order to overcome the experimental and theoretical difficulties: the experimental difficulties are due to the complicated interaction of the dominant factors while the theoretical difficulties are due to the nonlinear spring behavior and time-dependent excitation of ball bearings.

BELTS

85-2524

Design of Belt-Tensioner Systems for Dynamic Stability

A.G. Ulsoy, J.E. Whitesell, M.D. Hooven
Univ. of Michigan, Ann Arbor, MI
J. Vib., Acoust., Stress Rel. Des., Trans. ASME, 107 (3), pp 282-290 (July 1985), 14 figs, 1 table, 15 refs

KEY WORDS: Belt drives, Dynamic stability

Several potential instability mechanisms for belt-tensioner systems are described and a

design methodology is presented to ensure good dynamic performance of such systems. A mathematical model of the belt-tensioner system, and numerical solution methods, are utilized to develop a computer-aided design procedure. Numerical results, and confirming experimental data, are presented for a particular automotive belt-tensioner system.

FASTENERS

85-2525

An Assessment of the Impact Performance of Bonded Joints for Use in High Energy Absorbing Structures

J.A. Harris, R.D. Adams
Univ. of Bristol, UK

IMEchE, Proc. 199 (C2), pp 121-131 (1985), 15 figs, 2 tables, 8 refs

KEY WORDS: Joints, Bonded structures, Energy absorption

Using an instrumented impact test, the strength and energy absorption of bonded single lap joints have been measured for single lap joints with four epoxy adhesives and three aluminium alloy adherends. The effect of loading rate on bonded joint strength has been analyzed using a non-linear finite element method, from which predictions of joint strength in keeping with the experimental results have been obtained. Crush tests carried out on open-ended cylinders have been used to simulate the impact behavior of an energy absorbing structure.

85-2526

A Design Method for Reducing the Effects of Clearances at Revolute Joints

J.K. Shin, B.M. Kwak
Korea Advanced Inst. of Science and Technology, Seoul, Korea
IMEchE, Proc., 199 (C2), pp 153-158 (1985), 8 figs, 9 refs

KEY WORDS: Mechanisms, Joints, Clearance effects, Design Techniques

A method for designing a mechanism which is free of contact loss in clearance connections is developed. Only revolute joints are considered as possible clearance joints. This general theory was applied to a slider crank mechanism and it is shown that designing a perfect joint is theoretically possible through balancing by a nonlinear spring. This technique gives a practical guide for balancing a mechanism with linear springs to reduce the possibility of contact loss in clearance joints.

85-2527

Joint Deformations and Stresses of Commercial Vehicle Frame Under Torsion

H.J. Beermann
Technical Univ. of Braunschweig, W. Germany
Vehicle Structures, Intl. Conf. Institution of Mech.E, London, Conf. Pub. 1984-7, SAE-MEP 200, pp 171-180, 8 figs, 1 table, 10 refs

KEY WORDS: Joint stiffness, Cargo vehicles, Nonlinear theories

The flexibility of joints in commercial vehicle frames is shown; this is considered in frame analysis. Special problems arising in stress calculation are demonstrated. Nonlinear behavior is essential to dynamic analysis.

85-2528

Stochastic Crack Propagation in Fastener Holes

J.N. Yang, S.D. Manning, J.L. Rudd, W.H. Hsi
Structures, Structural Dynamics and Materials Conf., Proc. of 26th, held April 15-17, 1985, Orlando, Florida, spons. AIAA/-ASME/ASCE/AHS, Part 1, pp 225-233, 15 figs, 1 table, 26 refs

KEY WORDS: Fasteners, Fatigue life, Crack propagation

A simple crack growth rate-based stochastic model for fatigue crack propagation in fastener holes under spectrum loadings is

investigated. With available fractographic data in the very small crack size region, i.e., 0.004 to 0.07 inches, the model was demonstrated to be very good. Laboratory tests were conducted using wide fastener hole specimens to obtain fractographic data covering the small and large crack size regions in both laboratory air and a corrosive environment.

LINKAGES

85-2529

An Experimental Investigation into the Dynamic Behaviour of Revolute Joints with Varying Degrees of Clearance

R.S. Haines

NEI Reyrolle Power Switchgear, Hebburn, Tyne & Wear, NE31 1 UP, UK
Mech. Mach. Theory, 20 (3), pp 221-231 (1985), 9 figs, 1 table, 18 refs

KEY WORDS: Joints, Linkages, Clearance effects, Experimental data

Under static loads, the deflections associated with contact elasticity in a dry journal bearing were found to be much greater and less linear than predicted. Under a suddenly reversed uniaxial load, the air film was found to cause a dramatic change of behavior at reduced clearances. Under a load variation representative of that at a linkage mechanism joint, the behavior with the greatest clearance gave some support to an approximate theory published by the author.

VALVES

85-2530

Noise and Vibration Induced by Throttling of High Pressure Compressible Fluid (Part 1 - Characteristics of Noise and Vibration Generated by Cage-guided Control Valve)

R. Okutsu, E. Outa, S. Kuramochi, T. Machiyama

Waseda Univ., Okubo 3-4-1, Shinjuku, Tokyo, Japan
Bull. JSME, 28 (239), pp 837-845 (May 1985), 20 figs, 1 table, 16 refs

KEY WORDS: Valves, Fluid-induced excitation

Features of noise and vibration generated by a cage-guided control valve are discussed. In this type of valve, kinetic energy of the throttled jets is dissipated by mutual collision of the jets themselves. The pressure reduction process is made considerably smooth, and the noise level becomes lower than that of a freely expanding jet.

STRUCTURAL COMPONENTS

CABLES

85-2531

Karman Vortex Shedding, Friend or Foe of the Structural Dynamicist?

L.E. Ericsson

Lockheed Missiles & Space Co., Inc., Sunnyvale, CA

Structures, Structural Dynamics and Materials Conf., Proc. of 26th, held April 15-17, 1985, Orlando, Florida, spons. AIAA/-ASME/ASCE/AHS, Part 2, pp 238-250, 20 figs, 26 refs

KEY WORDS: Cables, Vortex shedding, Galloping

An analysis including the coupling between Karman vortex shedding and body motion has been performed for rectangular cross-sections. The analysis shows how the Karman vortex shedding can eliminate the large amplitude response for the so called galloping cable over large reduced velocity regions.

85-2532

The Phenomenon of Damping in Stranded Cables

I. Pivovarov, O.G. Vinogradov
Univ. of Calgary, Calgary, Alberta, Canada
Structures, Structural Dynamics and Materials Conf., Proc. of 26th, held April 15-17, 1985, Orlando, Florida, spons. AIAA/-ASME/ASCE/AHS, Part 2, pp 232-237, 4 figs, 2 tables, 6 refs

KEY WORDS: Cables, Damping coefficients, Hysteretic damping

Hysteretic loops and frequency response curves of a cantilever cable having a concentrated mass at the free end are investigated experimentally and modeled mathematically. Experimental observations show that hysteretic loops are frequency and amplitude dependent. To describe different damping mechanisms two nonlinear mathematical models are postulated: the first model takes into account the nonlinear stiffness and viscous and Coulomb type of damping, the second model, in addition to viscous damping, includes the Davidenkov's description of a hysteretic loop with sharp edges. These two models describe hysteretic loops with different shapes.

BEAMS

85-2533

Impact of a Prestressed Beam

D.P. Thambiratnam
National Univ. of Singapore, Kent Ridge, Singapore 0511
Structures, Structural Dynamics and Materials Conf., Proc. of 26th, held April 15-17, 1985, Orlando, Florida, spons. AIAA/-ASME/ASCE/AHS, Part 2, pp 363-368, 3 figs, 2 tables, 9 refs

KEY WORDS: Beams, Prestressed structures, Transient response, Wavefront expansion method

The response of a prestressed beam subjected to an end impact is treated using the method of wavefront expansion. The impact can be prescribed in the form of stress, strain, velocity or acceleration boundary conditions. The Timoshenko equations, modified to include the initial

stress, are used to model the beam. The analysis is based on the concept of a wave as a carrier of discontinuities in the field variables and their derivatives.

85-2534

Optimal Design of a Vibrating Beam with Coupled Bending and Torsion

S. Hanagud, C.V. Smith, Jr., A. Chattopadhyay
Georgia Inst. of Technology, Atlanta, GA
Structures, Structural Dynamics and Materials Conf., Proc. of 26th, held April 15-17, 1985, Orlando, Florida, spons. AIAA/-ASME/ASCE/AHS, Part 1, pp 780-792, 7 figs, 24 refs

KEY WORDS: Beams, Coupled response, Flexural vibration, Torsional vibration, Fundamental frequencies

The problem of maximizing the fundamental frequency of a thin walled beam with coupled bending and torsional modes is studied. An optimality criterion approach is used to locate stationary values of an appropriate objective function subject to constraints. Optimal designs with and without coupling are discussed.

85-2535

Vibrations of a Beam and a Moving Load with Sprung and Unsprung Masses

M. Yoshizawa, T. Takizawa, Y. Tsujioka
Keio Univ. 3-14-1 Hiyoshi, Kohoku-ku, Yokohama, Japan
Bull. JSME, 28 (239), pp 911-918 (May 1985), 10 figs 8 refs

KEY WORDS: Beams, Moving loads

This paper deals with the vibration of a simple beam under the action of a moving load, the two masses connected with a linear spring. It is shown that the vibration of this system consists of two modes, each of which has a time-dependent natural frequency. Using the above analytical result, the lateral vibration of the beam and the vertical oscillation of the sprung mass are shown for different ratios between the

natural frequencies of the moving load and the beam.

85-2536

Free Vibrations of Thin-Walled Pretwisted Beams under Axial Loadings (1st Report, Governing Equations of Motion)

T. Tsuji
Nagasaki Univ., Nagasaki, Japan
Bull. JSME, **28** (239), pp 894-898 (May 1985), 5 figs, 7 refs

KEY WORDS: Beams, Initial deformation effects, Coupled response, Torsional vibrations, Longitudinal vibrations

The derivation of the equations governing the response of a thin-walled pretwisted beam under axial loadings is presented. The equations of motion, taking into account the coupling effects of torsional and longitudinal vibrations and deformations due to axial loading, are derived. Frequency parameters of the coupled torsional and longitudinal vibrations for pretwisted cantilever beams of thin rectangular cross-section are obtained under axial tensile forces.

85-2537

Penalty Finite Element Models for Non-linear Dynamic Analysis

A.K. Noor, J.M. Peters
NASA Langley Res. Ctr., Hampton, VA
Structures, Structural Dynamics and Materials Conf., Proc. of 26th, held April 15-17, 1985, Orlando, Florida, spons. AIAA/ASME/ASCE/AHS, Part 2, pp 369-378, 10 figs, 2 tables, 18 refs

KEY WORDS: Curved beams, Finite element technique

A simple penalty finite element formulation is presented for the large-rotation dynamic analysis of curved beams. The analytical formulation is based on a form of Reissner's large-deformation theory with the effects of transverse shear deformation and the extensibility of the centerline constrained through the use of the penalty method. Reduced integration is used in

evaluating the elemental stiffness arrays and the temporal integration is performed by using Newmark's method. Numerical results are presented to demonstrate the effectiveness of the finite elements developed.

85-2538

An Improved Finite Difference Analysis of Uncoupled Vibrations of Cantilevered Beams

K.B. Subrahmanyam, A.W. Leissa
Ohio State Univ., Columbus, OH
J. Sound Vib., **98** (1), pp 1-11 (Jan 8, 1985), 3 tables, 11 refs

KEY WORDS: Cantilever beams, Natural frequencies, Mode shapes, Finite difference technique

Natural frequencies and mode shapes of uniform cantilever beams are obtained with use of the first and second order central difference schemes. It is observed that the improved finite difference scheme with second order central differences produces the natural frequencies and characteristic functions, with a rapid convergence as compared to the conventional approach of using the first order central differences. The present approach facilitates a direct determination of the dynamic characteristics of beams without any necessity of extrapolations of the results or application of iterative procedures for improving the accuracy.

MEMBRANES, FILMS, AND WEBS

85-2539

Impact of Spherical Membranes Partially Filled with Water and Air

C.W. Bert, D.R. Bert
The Univ. of Oklahoma, Norman, OK
Structures, Structural Dynamics and Materials Conf., Proc. of 26th, held April 15-17, 1985, Orlando, Florida, spons. AIAA/ASME/ASCE/AHS, Part 2, pp 357-362, 4 figs, 3 tables, 10 refs

KEY WORDS: Membranes, Fluid-filled containers, Impact response

Experimental results on three series of impact experiments on flexible spherical membranes (soccer balls) are presented. Some appropriate simple analyses are also presented.

PANELS

85-2540

Modal Response and Noise Transmission of Composite Panels

F.W. Grosveld, V.L. Metcalf

The Bionetics Corp., Hampton, VA
Structures, Structural Dynamics and Materials Conf., Proc. of 26th, held April 15-17, 1985, Orlando, Florida, spons. AIAA/ASME/ASCE/AHS, Part 2, pp 617-627, 15 figs, 5 tables, 20 refs

KEY WORDS: Panels, Fiber composites, Noise transmission, Modal analysis

Noise transmission through flat, rectangular, fiber reinforced composite panels has been investigated analytically and experimentally. Utilizing modal decomposition, theoretical solutions of the governing differential equation of motion were obtained for a specially orthotropic composite panel. Experimental modal analysis was performed to extract the modal frequencies and damping of several composite panels. These modal parameters then were used to predict the field-incidence transmission loss.

85-2541

The Measurement of Acoustic Properties of Limited Size Panels by Use of a Parametric Source

V.F. Humphrey

Univ. of Bath, Bath BA2 7AY, UK
J. Sound Vib., 28 (1), pp 67-81 (Jan 8, 1985), 15 figs, 16 refs

KEY WORDS: Panels, Submerged structures, Acoustic properties

A method of measuring the acoustic properties of limited size panels immersed in

water, with a truncated parametric array used as the acoustic source, is described. The insertion loss and reflection loss of thin metallic panels, typically 0-45 m square, were measured at normal incidence by using this technique. Results were obtained for a wide range of frequencies (10 to 100 kHz) and were found to be in good agreement with the theoretical predictions for plane waves.

PLATES

85-2542

Effects of Transverse Shearing on Cylindrical Bending, Vibration, and Buckling of Laminated Plates

M. Stein, D.C. Jegley

NASA Langley Research Ctr., Hampton, VA
Structures, Structural Dynamics and Materials Conf., Proc. of 26th, held April 15-17, 1985, Orlando, FL, spons. AIAA/ASME/ASCE/AHS, Part 1, pp 505-515, 10 figs, 11 refs

KEY WORDS: Plates, Beams, Transverse shear deformation effects, Layered materials

The displacements for cylindrical bending and stretching of laminated and thick plates are expressed through-the-thickness by a few algebraic terms and a complete set of trigonometric terms. Only a few terms of this series are needed to get sufficiently accurate results for laminated and thick plates. Equations of equilibrium based on a sufficient number of terms of this series for displacements are determined using variational theorems from three-dimensional elasticity.

85-2543

Optimal Design of Stiffened Laminated Composite Plates with Frequency Constraints

L.C. Mesquita, M.P. Kamat

Virginia Polytechnic Inst. and State Univ., Blacksburg, VA

Structures, Structural Dynamics and Materials Conf., Proc. of 26th, held April 15-17, 1985, Orlando, Florida, spons. AIAA/-ASME/ASCE/AHS, Part 1, pp 825-833, 2 figs, 4 tables, 10 refs

KEY WORDS: Plates, Layered materials, Fundamental frequencies

The authors consider the problem of maximization of the fundamental frequency of a stiffened laminated composite plate of a given configuration subject to an upper bound on its total weight, and to the requirement that the first few frequencies be separated from the first frequency by prescribed ratios.

85-2544

The Vibration Analysis of Carbon Fibre - Glass Fibre Sandwich Hybrid Composite Plates

D.X. Lin, R.G. Ni, R.D. Adams
Shaanxi Inst. of Mechanical Engrg. Xian, China

Structures, Structural Dynamics and Materials Conf., Proc. of 26th, held April 15-17, 1985, Orlando, Florida, spons. AIAA/-ASME/ASCE/AHS, Part 2, pp 120-125, 1 fig, 4 tables, 5 refs

KEY WORDS: Plates, Composite materials, Finite element technique, Damping coefficients

A finite element technique using a damped element and allowing for shear deformation is used for the prediction of the vibrational characteristics of hybrid carbon/glass fiber-reinforced plastics composite plates. The theory is briefly presented and assessed by comparing with experimental results on natural frequencies, mode shapes and damping values.

85-2545

Multiple Mode Nonlinear Dynamic Analysis of Composite Moderately Thick Elliptical Plates

M. Sathyamoorthy
Clarkson Univ., Potsdam, NY 13676

Structures, Structural Dynamics and Materials Conf., Proc. of 26th, held April 15-17, 1985, Orlando, Florida, spons. AIAA/-ASME/ASCE/AHS, Part 2, pp 201-207, 4 figs, 3 tables, 12 refs

KEY WORDS: Plates, Flexural vibration, Transverse shear deformation effects, Rotatory inertia effects

A theoretical investigation of large amplitude flexural vibration of clamped, moderately thick composite elliptical plates is carried out. Von Karman-type field equations which are given in terms of the three displacement components of the plate are used. Included in these field equations are the effects of transverse shear deformation and rotatory inertia such that they can readily be used for moderately thick plates of any plate geometry. Solutions to these governing equations are obtained by using a multiple-mode approach and employing Galerkin's method and the numerical Runge-Kutta procedure.

85-2546

Moving Harmonic Load on a Prestressed Thick Strip Plate

S. Chonan, S. Sugawara
Tohoku Univ., Sendai, Japan
J. Vib., Acoust., Stress, Rel. Des., Trans. ASME, 107 (3), pp 291-295 (July 1985), 7 figs, 12 refs

KEY WORDS: Plates, Moving loads, Harmonic excitation, Rotatory inertia effects, Transverse shear deformation effects

The steady-state response of an initially stressed, thick strip plate subjected to a sinusoidally oscillating moving line load is studied. The problem is studied on the basis of a thick plate theory which takes into account the effect of the second-order increments of the normal stresses as well as the effect of rotatory inertia and shear deformations. Critical speed for which a resonance effect occurs in the system is obtained.

85-2547

Aero/Hydrodynamic Stability of Elastically

Supported Plates in Narrow Channels with Upstream Barriers Preventing Flow Redistribution

W.D. Mark
Bolt Beranek and Newman, Inc., Cambridge, MA
J. Vib., Acoust., Stress Rel. Des., Trans. ASME, 107 (3), pp 319-328 (July 1985), 7 figs, 22 refs

KEY WORDS: Plates, Elastic supports, Fluid induced excitation

The dynamic stability of an elastically supported finite rigid plate centered in a straight narrow channel with incompressible flow on both sides of the plate and an upstream barrier preventing flow redistribution is analyzed. An integral equation for the pressure in a narrow channel having arbitrary small time-dependent boundary displacements is formulated and solved for the pressure distribution in terms of the boundary motion. The resulting expression for the time-dependent pressure distribution is combined with the plate differential equations of motion to yield the homogeneous equations of motion of the plate-fluid autonomous system.

**85-2548
Free Vibration of Polar-Orthotropic Sector Plates Resting on Point Supports**

Y. Narita
Hokkaido Inst. of Technology, Sapporo 061-24, Japan
J. Vib., Acoust., Stress Rel. Des., Trans. ASME, 107 (3), pp 334-338 (July 1985), 5 figs, 3 tables, 16 refs

KEY WORDS: Plates, Ritz method

An accurate Ritz solution for the free vibration of point-supported annular sector plates of polar orthotropy is presented. A double power series function is used to represent deflection of the plate, with Lagrange multipliers to impose the constraint conditions. To establish accuracy of the approach, the frequency parameters of sector plate with some supporting points distributed along the boundary are compared to those of a uniformly simply supported plate.

**85-2549
Free Vibration of Stiffened Rectangular Plates Using Green's Functions and Integral Equations**

J.W. Nicholson
Univ. of Illinois, Urbana-Champaign, IL
Structures, Structural Dynamics and Materials Conf., Proc. of 26th, held April 15-17, 1985, Orlando, Florida, spon. AIAA/ASME/ASCE/AHS, Part 2, pp 184-191, 8 figs, 1 table, 16 refs

KEY WORDS: Rectangular plates, Green function, Fredholm equation, Natural frequencies, Mode shapes

A new method for the free vibration analysis of stiffened rectangular plates based on the use of Green's functions and the solution of a system of Fredholm integral equations of the second kind is demonstrated. The lateral forces of constraint and the twisting moments of constraint between the plate and beam-stiffeners is accounted for. For plates with simply supported edges perpendicular to the stiffeners the integral equations are solved exactly to yield the characteristic equations for the natural frequencies.

**85-2550
Finite Element Nonlinear Forced Vibration Analysis of Symmetrically Laminated Composite Rectangular Plates**

Chuh Mei, C.K. Chiang
Old Dominion Univ., Norfolk, VA
Structures, Structural Dynamics and Materials Conf., Proc. of 26th, held April 15-17, 1985, Orlando, Florida, spon. AIAA/ASME/ASCE/AHS, Part 2, pp 208-218, 3 figs, 5 tables, 18 refs

KEY WORDS: Rectangular plates, Layered materials, Forced vibration, Finite element technique

A finite element formulation is presented for determining the large amplitude, steady-state, forced vibrational response of symmetrically laminated composite rectangular thin plates. Nonlinear stiffness and harmonic force matrices of a rectangular symmetrically laminated composite plate element are developed for nonlinear forced

vibration analysis. Inplane deformation and inertia are both included in the formulation.

85-2551

Linear and Nonlinear Vibrations Caused by Periodic Impulses

E. Suhir

AT&T Bell Labs., Murray Hill, NJ
Structures, Structural Dynamics and Materials Conf., Proc. of 26th, held April 15-17, 1985, Orlando, Florida, spons. AIAA/ASME/ASCE/AHS, Part 2, pp 224-231, 5 figs, 10 refs

KEY WORDS: Rectangular plates, Transient vibrations, Periodic vibrations, Period excitation

Linear and nonlinear steady-state and transient vibrations caused by periodic impulses are discussed. Deterministic and probabilistic approaches are examined, and the case of the dynamic response of an elongated rectangular plate is used to illustrate the two techniques.

85-2552

Analysis of Vibrating Orthotropic Rectangular Plates by a Modified Rayleigh-Ritz Method

P.A.A. Laura, J.P. Viazzi
Inst. of Applied Mechanics, Puerto Belgrano Naval Base, 8111 Argentina
Ocean Engrg., 12 (1), pp 17-24 (1985), 4 figs, 2 tables, 4 refs

KEY WORDS: Rectangular plates, Orthotropism, Rayleigh-Ritz method

The title problem is solved in the case where the plate is clamped along two adjacent edges while the remaining are free. A mass is rigidly attached to the plate. The value of the fundamental frequency coefficient is conveniently minimized by means of Schmidt's approach. The methodology presented herewith can be extended without formal difficulties to other vibrating systems.

85-2553

The Natural Frequencies of In-Plane Stressed Rectangular Plates

S. Hanko, S.C. Tillman

Univ. of Manchester, Manchester, UK

J. Sound Vib., 98 (1), pp 25-34 (Jan 8, 1985), 7 figs, 4 tables, 17 refs

KEY WORDS: Rectangular plates, Natural frequencies, Finite difference technique, Computer programs

The stress distributions in some practical in-plane loaded plates have been obtained either directly via strain gauges or indirectly from the measurement of transverse deflections or initial imperfection profiles. These stress distributions have been incorporated into a purpose-written finite difference computer program set up to evaluate the natural frequencies of the plates. A comparison has been made between these frequencies and those measured directly in the laboratory.

85-2554

Finite Element Method for Nonlinear Forced Vibrations of Circular Plates

K. Decha-Umphai

Old Dominion Univ., Norfolk, VA

Structures, Structural Dynamics and Materials Conf., Proc. of 26th, held April 15-17, 1985, Orlando, Florida, spons. AIAA/ASME/ASCE/AHS, Part 2, pp 192-200, 9 figs, 4 tables, 13 refs

KEY WORDS: Circular plates, Finite element technique, Nonlinear theories

Geometric nonlinearities for large amplitude free and forced vibrations of circular plates are investigated. Inplane displacement and inertia are included in the formation. The finite element method is used. Harmonic force matrix for nonlinear forced vibration analysis is introduced and derived. Various out-of-plane and inplane boundary conditions are considered. The relations of amplitude - frequency ratio for different boundary conditions and various loads conditions are presented.

85-2555

Experimental Study of Free Vibration of Circular Plates with a Straight Eccentric Narrow Slit

K. Maruyama, O. Ichinomiya
Hokkaido Inst. of Technology, Hokkaido, 061-24, Japan
Bull. JSME, 28 (239), pp 890-893 (May 1985), 3 figs, 1 table, 2 refs

KEY WORDS: Circular plates, Mode shapes, Flexural vibrations, Natural frequency, Discontinuity-containing media

The real time technique of time averaged holographic interferometry has been applied to determine the natural frequencies, and the corresponding mode shapes for the transverse vibrations of clamped circular plates with a straight eccentric narrow slit. Eccentricity and length of the slit have been selected as parameters, while width of the slit has been kept constant. The first six natural modes are discussed.

85-2556

On Squeeze Film of a Curved Circular Plate

E. Hasegawa
Keio Univ., Yokohama 223, Japan
Bull. JSME, 28 (239), pp 951-958 (May 1985), 6 figs, 6 refs

KEY WORDS: Curved plates, Squeeze-film dampers

The problem of a squeeze film between a curved circular plate and a plane wall is studied theoretically. The shape of the curved circular plate is assumed to be axisymmetric; that is, to be expressed by a function of only the radius coordinate. A perturbation solution is found in powers of ratio of the gap to the radius. The equation governing the gap is derived for a curved disk with any shape. The properties of the squeeze film are clarified through the force-gap relation, the critical external force, the inertia effect and the pressure distribution.

85-2557

Flutter Analysis of Cantilevered Quadrilateral Plates

R.S. Srinivasan, B.J.C. Babu
FRP Res. Ctr., Indian Inst. of Technology, Madras 600 036, India
J. Sound Vib., 28 (1), pp 45-53 (Jan 8, 1985) 2 figs, 3 tables, 11 refs

KEY WORDS: Cantilevered plates, Flutter

The title problem is solved by using a numerical method involving an integral equation technique and a normal mode method. Linear plate theory has been used for computing the strain and kinetic energy of the plate. Piston theory has been used to describe the aerodynamic pressure distribution. Numerical work has been done and convergence of the solution has been studied.

SHELLS

85-2558

Approach to Interior Noise Control Part II: Self-Supporting Damped Interior Shell

C.I. Holmer
Cabot Corp., Indianapolis, IN
J. Aircraft, 22 (8), pp 729-733 (Aug 1985) 4 figs, 6 refs

KEY WORDS: Shells, Noise reduction, Structure borne noise, Interior noise, Aircraft noise

A companion paper present theoretical and experimental data identifying the significance of panel critical frequency and structural damping in controlling trim panel dynamic response from excitation at attachment points. This paper explores a logical extension to the trim panel system. The shell presents several desirable nonacoustic properties that may offer design or construction economies. Of concern here is the design considerations that can turn potential acoustic problems into significant advantages.

85-2559

Three Dimensional Nonlinear Dynamic Finite Element Analysis for the Response of a Thick Laminated Shell to Impact Loads

R.E. McCarty, D.E. Trudan, A.D. Davis
Air Force Wright Aeronautical Labs.,
Wright-Patterson Air Force Base, OH
Structures, Structural Dynamics and Materi-
als Conf., Proc. of 26th, held April 15-17,
1985, Orlando, Florida, spon. AIAA/-
ASME/ASCE/AHS, Part 2, pp 341-356, 26
figs, 2 tables, 30 refs

KEY WORDS: Shells, Layered materials,
Impact response, Aircraft windows, Bird
impact

The response of the T-38 aircraft student
windshield structural assembly to bird
impact loading is simulated using the
MAGNA (materially and geometrically
nonlinear analysis) three-dimensional non-
linear finite element analysis system. User
subroutines are used to couple the mathe-
matical definition of the bird impact pres-
sures to the computed response of the
aircraft windshield assembly. These pres-
sures are applied to the faces of finite
elements lying within the bird impact foot-
print on the surface of the windshield. The
analysis problem is characterized by severe
material and geometric nonlinearities as
well as significant fluid/solid interaction
(load/response coupling).

85-2560

**The Effect of Source Location on the
Structural-Acoustic Interaction of an Infinite
Elastic Shell**

J.J. Kelly, C.R. Fuller
Old Dominion Univ., Norfolk, VA
Structures, Structural Dynamics and Materi-
als Conf., Proc. of 26th, held April 15-17,
1985, Orlando, Florida, spon. AIAA/-
ASME/ASCE/AHS, Part 2, pp 609-616, 14
figs, 7 refs

KEY WORDS: Shells, Acoustic response

The response of an infinite elastic shell to
simple acoustic sources (monopole and
dipole) is investigated. This simplified
model is considered in order to gain insight
into the characteristics of aircraft interior
noise. The shell represents the aircraft
fuselage and the sources are due to the
propeller. The location of the source with
respect to the cylinder and how this affects

acoustic line power, intensity flow into the
shell and internal sound pressure is ana-
lyzed.

85-2561

Response of Double Wall Composite Shells

R. Vaicaitis, D.A. Bofilios
Columbia Univ., New York, NY
Structures, Structural Dynamics and Materi-
als Conf., Proc. of 26th, held April 15-17,
1985, Orlando, Florida, spon. AIAA/-
ASME/ASCE/AHS, Part 2, pp 110-119, 12
figs, 18 refs

KEY WORDS: Cylindrical shells, Layered
materials, Viscoelastic core-containing
materials, Natural frequencies, Power spec-
tral densities

An analytical study of double wall laminate
cylindrical shell response to random loads
is presented. A soft viscoelastic core with
dilatational modes included is used. The
theory of laminate shells is simplified by
assumptions similar to those in the Don-
nell-Mushtari development for isotropic
shells. Modal solutions of simply supported
shells are obtained. Modal frequencies and
deflection response spectral densities are
determined.

PIPES AND TUBES

85-2562

Wave Forces on Large Offshore Pipelines
N.J. Shankar, H. Raman, V. Sundar
National Univ. of Singapore, Kent Ridge,
Singapore

Ocean Engrg., 12 (2), pp 99-115 (1985), 11
figs, 14 refs

KEY WORDS: Pipelines, Offshore struc-
tures, Wave forces, Experimental data

A laboratory investigation of wave forces
induced by a regular train of waves on a
large pipeline resting on a bed and at
various clearances from the bed is pre-
sented. A simple unseparated flow model

based on potential flow theory and Morison's equation is presented for evaluating the maximum forces on the pipeline. The experimental results are compared with the theoretical results and data from existing literature.

DYNAMIC ENVIRONMENT

ACOUSTIC EXCITATION

85-2563

An Integral Equation Method for Predicting Acoustic Emission within Enclosures

D.T.L. Francis, M.M. Sadek
City of Birmingham Polytechnic
IMechE, Proc., 199 (C2), pp 133-137 (1985),
2 figs, 10 refs

KEY WORDS: Noise generation, Acoustic emission, Enclosures, Prediction techniques

A method is presented for calculating the acoustic emission of a vibrating body within an enclosure whose surface has known absorption characteristics. It is based on a numerical solution of the Helmholtz integral equation. Solutions are given for the case of a pulsating sphere within a sphere, and good agreement with the exact analytical solution is reported. The method is of value for small and medium scale problems at lower frequencies where traditional techniques are less reliable.

85-2564

On the Effect of Terrain Profile on Sound Propagation Outdoors

K.B. Rasmussen
Danish Acoustical Inst., Technical Univ. of Denmark, Lyngby, Denmark
J. Sound Vib., 98 (1), pp 35-44 (Jan 8, 1985) 13 figs, 21 refs

KEY WORDS: Sound waves, Wave propagation, Noise barriers

Various models describing outdoor sound propagation over wedge barriers and three-sided barriers are described. The theoretical results are compared with measured data for sound propagation over grass-covered earth berms from a loudspeaker source. Calculated and measured results for a road traffic noise situation involving an earth berm are also presented.

85-2565

Review of Research on Structureborne Noise

R. Vaicaitis, J.S. Mixson
Structures, Structural Dynamics and Materials Conf., Proc. of 26th, held April 15-17, 1985, Orlando, FL, spons. AIAA/ASME/ASCE/AHS, Part 2, pp 587-601, 16 figs, 150 refs

KEY WORDS: Structural-borne noise, Aircraft noise

Publications on the topic of structure-borne noise are reviewed. Recent accomplishments, including representative results, are presented for aircraft, rotorcraft, space structures, automotive vehicles, ship and building technology. Special attention is given to propeller-driven aircraft.

85-2566

Theory and Practice in Exhaust System Design

L.J. Eriksson, P.T. Thawani
Nelson Industries, Inc.
Surface Vehicle Noise and Vibration Conf. Proc., Traverse City, MI, May 15-17, 1985. Spons. Society of Automotive Engineers, Warrendale, PA, pp 257-266, 10 figs, 20 refs

KEY WORDS: Exhaust systems, Mufflers

A number of theoretical results related to exhaust systems is presented and some of their practical implications for design are discussed. A brief review is included of exhaust system theory as well as experimental results obtained on actual units. The connection between theory and practice

is then analyzed for reactive effects, resistive effects, and engine interactions. The emphasis throughout the paper is on the use of theory to guide practical design.

85-2567

A Systematic Approach to the Analysis of Brake Noise

H.W. Schwartz, W.D. Hays, Jr., J.H. Tarter
Allied Automotive
Surface Vehicle Noise and Vibration Conf.
Proc., Traverse City, MI, May 15-17, 1985.
Spons. Society of Automotive Engineers,
Warrendale, PA, pp 267-275, 5 figs, 4 refs

KEY WORDS: Brakes, Noise generation, Noise reduction

A systematic approach to the control of disc brake noise is suggested. Test methods are described, based on the use of modern techniques, along with approaches to the design of quiet brakes which consider not only friction material, but also friction pad assembly and other components.

85-2568

On the Long Range Propagation of Sound Over Irregular Terrain

M.S. Howe
Bolt Beranek and Newman Inc., Cambridge, MA
J. Sound Vib., 98 (1), pp 83-94 (Jan 8, 1985) 3 figs, 34 refs

KEY WORDS: Sound waves, Wave propagation, Surface roughness

The theory of sound propagation over randomly irregular, normally plane terrain of finite impedance is discussed. The analysis is an extension of the theory of coherent scatter originally proposed by Biot for an irregular rigid surface. It combines Biot's approach, wherein the surface irregularities are modeled by a homogeneous distribution of hemispherical bosses, with more conventional analysis in which the ground is modeled as a smooth plane of finite impedance.

85-2569

Diffraction Sound Field by a Circular Aperture in the Surface of a Rectangular Enclosure

K. Nishida, A. Maruyama
Muroran Inst. of Tech., Muroran, Hokkaido, Japan
Bull. JSME, 28 (239), pp 931-936 (May 1985) 4 figs, 6 refs

KEY WORDS: Sound waves, Wave diffraction

The diffraction sound field generated by a circular aperture in the surface of a rectangular enclosure containing a sound source inside is theoretically and experimentally investigated. The applicability of Pierce's approximate solution of sound diffraction by a three-sided semi-infinite wall to finite three dimensional bodies is examined. The properties of diffraction sound field around the enclosure are obtained through sound visualization method.

85-2570

The Performance of Jet Noise Suppression Devices for Industrial Applications

M.D. Dahl, O.H. McDaniel
NASA Lewis Res. Ctr., Cleveland, OH
J. Vib., Acoust., Stress Rel. Des., Trans. ASME, 107 (3), pp 303-309 (July 1985) 6 figs, 15 refs

KEY WORDS: Jet noise, Noise reduction, Exhaust noise, Silencers

Commercially available jet noise suppression devices were tested to determine their noise reducing characteristics compared to an open pipe. Both exhaust silencers and ejector nozzles were measured for sound power level and mass flow rate. In addition for ejector nozzles, the added noise from a jet impinging on a flat plate was measured.

SHOCK EXCITATION

85-2571

Shock Associated Noise of Inverted-Profile Coannular Jets, Part I: Experiments

H.K. Tanna, W.H. Brown, C.K.W. Tam
Lockheed-Georgia Co., Marietta, GA 30063
J. Sound Vib., 28 (1), pp 95-113 (Jan 8,
1985), 12 figs, 2 tables, 17 refs

KEY WORDS: Shock waves, Noise genera-
tion

The reduction of shock-associated noise in inverted-velocity-profile coannular jets is quantified and explained. Extensive optical and acoustic measurements for a suitable range of outer and inner stream pressure ratio combinations are conducted. The measured noise results are interpreted with the aid of new theoretical models.

85-2572

Shock Associated Noise of Inverted-Profile Coannular Jets, Part II: Condition for Minimum Noise

C.K.W. Tam, H.K. Tanna
Lockheed-Georgia Co., Marietta, GA 30063
J. Sound Vib., 28 (1), pp 115-125 (Jan 8,
1985), 4 figs, 1 table, 10 refs

KEY WORDS: Shock waves, Noise genera-
tion

An experimental and theoretical investigation of shock-associated noise of inverted-profile coannular jets is described. For a fixed fan-stream Mach number, it is observed that the shock-associated noise often drops suddenly to a minimum as the reservoir pressure of the primary jet increases. When this happens, the almost periodic shock cell structure of the fan stream is found to nearly completely disappear.

85-2573

Shock Associated Noise of Inverted-Profile Coannular Jets, Part III: Shock Structure and Noise Characteristics

C.K.W. Tam, H.K. Tanna
Lockheed-Georgia Co., Marietta, GA
J. Sound Vib., 28 (1), pp 127-145 (Jan 8,
1985), 8 figs, 1 table, 9 refs

KEY WORDS: Shock waves, Noise genera-
tion

The basic objective of the work described is to obtain an understanding of the characteristics of shock associated noise from inverted-profile coannular jets in terms of the properties of the shock cell structure and the jet flow. To achieve this, a first-order shock-cell model is developed. Based on the concept that shock-associated noise is generated by the weak interaction between the large-scale turbulent structures in the mixing layers of the jet and the repetitive shock-cell system, formulae for the peak frequencies as well as noise intensity scaling are derived.

VIBRATION EXCITATION

85-2574

The Decomposition Method in Stochastic Structural Dynamics

H. Benaroya, M. Rehak
Weidlinger Associates, New York, NY
Structures, Structural Dynamics and Materials Conf., Proc. of 26th, held April 15-17,
1985, Orlando, Florida, spons. AIAA/
ASME/ASCE/AHS, Part 2, pp 266-281, 56
figs, 13 refs

KEY WORDS: Random vibrations, Frequency
domain method

Linear, random differential equations are studied with the purpose of understanding the effects of parameter uncertainties on the random vibration of structures. A single degree-of-freedom oscillator with random (stationary) stiffness and input, and with deterministic, constant mass and damping is considered.

85-2575

An Iterative Procedure for Nonlinear Flutter Analysis

C.L. Lee
Texas Instruments Inc., Lewisville, TX
Structures, Structural Dynamics and Materials Conf., Proc. of 26th, held April 15-17,
1985, Orlando, Florida, spons. AIAA/
ASME/ASCE/AHS, Part 2, pp 290-297, 13
figs, 5 tables, 21 refs

KEY WORDS: Flutter, Iteration, Frequency domain method

An iterative procedure in the frequency domain is presented for flutter analysis of large dynamic systems with multiple structural nonlinearities. The major components of the procedure are the describing function approach for system linearization, a structural dynamics modification method for shifting system mode shapes and frequencies, and a complex eigenvalue algorithm for solution of the flutter equation. The purpose of the procedure is to achieve alignment of the oscillator amplitude in each nonlinear spring with the describing function of stiffness before computing the final stability characteristics. The result is a system tuned to the flutter frequency at the time of instability.

85-2576

Transient Aerodynamic Characteristics of a Two-Dimensional Airfoil During Stepwise Incidence Variation

Y. Aihara, H. Koyama, A. Murashige
University of Tokyo, Tokyo, Japan
J. Aircraft, 22 (8), pp 661-668 (Aug 1985)
13 figs, 14 refs

KEY WORDS: Airfoils, Aerodynamic Characteristics

The transient aerodynamic characteristics of a two-dimensional low-speed airfoil whose angle of attack is varied impulsively are discussed. The study is mainly an experimental one with observations made of the three dynamic loads, the static pressure distribution, and flow on the airfoil surface, following the airfoil motion. The changes in the characteristics and their aerodynamic causes are investigated in terms of the ultimate angle of attack and the rise of time.

85-2577

Viscous Effects on Transonic Airfoil Stability and Response

H.M. Berry, J.T. Batina, T.Y. Yang
Purdue University, West Lafayette, IN

Structures, Structural Dynamics and Materials Conf., Proc. of 26th, held April 15-17, 1985 Orlando, FL, Spons. AIAA/ASME/ASCE/AHS, Part 2, pp 10-22, 13 figs, 4 tables, 20 refs

KEY WORDS: Airfoils, Aerodynamics loads, Stability, Viscosity effects, Flutter

Viscous effects on transonic airfoil stability and response are investigated using an integral boundary layer model coupled to the inviscid XTRAN2L transonic airloads required for stability analysis including viscous effects. Unsteady transonic airloads required for stability analysis are computed using a pulse transfer-function analysis including viscous effects. The pulse analysis provides unsteady aerodynamic forces for a wide range of reduced frequency in a single flowfield computation. Nonlinear time-marching aeroelastic solutions are presented which show the effects of viscosity on airfoil response behavior and flutter.

MECHANICAL PROPERTIES

DAMPING

85-2578

Unconstrained Layer Damping and the Use of Modified PVA as a High Efficiency Lightweight Material

D.W. Tomkins
Gerard Thomas Co., Inc.
Surface Vehicle Noise and Vibration Conf. Proc., Traverse City, MI, May 15-17, 1985. Spons. Society of Automotive Engineers, Warrendale, PA, pp 53-59, 7 figs

KEY WORDS: Layered damping, Viscoelastic properties, Automobiles

A lightweight polymeric visco-elastic sheet material has been developed which exhibits excellent vibration damping performance when used as an unconstrained layer on sheet metal panels. Geiger plate decay rates of 26 dB/sec and have been meas-

ured. The sheet is flexible, non-toxic, and meets automotive and building flammability specifications.

85-2579

Dual Clearance Squeeze Film Damping for High Load Conditions

D.P. Fleming

Lewis Res. Ctr., Cleveland, OH

J. Tribology, Trans. ASME, 107 (2), pp 274-279 (Apr 1985) 8 figs, 9 refs

KEY WORDS: Squeeze film dampers

Squeeze film dampers are widely used to control vibrations in aircraft turbine engines and other rotating machinery. However, if shaft unbalance rises appreciably above the design value (e.g., due to turbine blade loss), a conventional squeeze film will be overloaded, and will no longer be effective in controlling vibration amplitudes and bearing forces.

85-2580

Forced Vibration of a Damped Combined Linear System

L.A. Bergman, J.W. Nicholson

Univ. of Illinois, Urbana-Champaign, IL

J. Vib., Acoust., Stress Rel. Des., Trans. ASME, 107 (3), pp 275-281 (July 1985) 8 figs, 4 tables, 14 refs

KEY WORDS: Damped structures, Linear systems, Forced vibration

A new and general method for determining the exact undamped natural frequencies and natural modes of vibration, the orthogonality relation for the natural modes, and the response to arbitrary excitation for both damped and undamped combined linear systems, is given. The method, based upon Green's functions of the vibrating distributed subsystems, is demonstrated for a multiplicity of linear oscillators connected to a simple beam.

85-2581

Damping Synthesis Using Complex Substruc-

ture Modes and a Hermitian System Representation

J.-G. Beliveau, Y. Soucy

Universite de Sherbrooke, Sherbrooke (Quebec) Canada

Structures, Structural Dynamics and Materials Conf., Proc. of 26th, held April 15-17, 1985, Orlando FL, spons. AIAA/ASME/-ASCE/AHS, Part 2, pp 581-586, 1 fig, 4 tables, 12 refs

KEY WORDS: Modal damping, Modal synthesis, Mode shapes, Natural frequencies

Modal synthesis techniques have long been used to evaluate the natural frequencies and mode shapes of systems for which modal characteristics of the various components have been determined, either experimentally or numerically. Little attention has been given in the prediction of damping levels of the total structure from damping information obtained experimentally, usually in the form of modal damping ratios and complex or real mode shapes. The purpose of this note is to present such a method, to demonstrate its use on a simple example, and to discuss two numerical aspects related to its numerical implementation.

85-2582

An Upper Hessenberg Sparse Matrix Algorithm for Modal Identification on Minicomputers

S.R. Ibrahim

Old Dominion University, Norfolk, Virginia Structures, Structural Dynamics and Materials Conf., Proc. of 26th, held April 15-17, 1985, Orlando, FL, Spons. AIAA/ASME/-ASCE/AHS, Part 2, pp 664-672, 2 tables, 44 refs

KEY WORDS: Modal analysis, Time domain method, Damping coefficients

The time domain identification problem is reduced to an eigenvalue problem of a sparse upper Hessenberg matrix. Such a matrix has only a number of elements equal to its order (one column); subdiagonal elements of unity and all the other remaining elements are zeros.

85-2583

Electronic Damping Techniques and Active Vibration Control

S. Hanagud, M.W. Obal, M. Meyyappa
Georgia Institute of Technology, Atlanta, GA
Structures, Structural Dynamics and Materials Conf., Proc. of 26th, held April 15-17, 1985, Orlando FL, Spons. AIAA/ASME/ASCE/AHS, Part 2, pp 443-453, 6 figs, 8 tables, 18 refs

KEY WORDS: Active vibration control, Damping effects

A theory has been developed to quantitatively identify changes in a damping matrix of structural dynamic system when electronic damping is applied to the system. Electronic damping experiments were conducted on a cantilever beam under impact excitation conditions. Piezoceramic transducers were used as both sensors and drivers with a velocity feedback. The mass, stiffness and damping matrices of the cantilever beam before and after application of the electronic damping were identified by a parameter identification technique that is capable of considering general linear viscous damping matrices.

FATIGUE

85-2584

Effect of Load Variation on Surface Durability of Normalized Steel Roller

S. Oda, T. Koide, J. Ando
Tottori Univ., Koyama-cho, Tottori, Japan
Bull. JSME, 28 (239), pp 964-970 (May 1985) 19 figs, 12 refs

KEY WORDS: Mechanical components, Steel, Compaction equipment

The characteristics of surface durability of an S45C normalized steel roller under two-step loading conditions are discussed on the basis of Miner's rule.

85-2585

A Combined Method for Damage Tolerance Analysis

A.S. Kuo, J.L. Rudd

Fairchild Republic Co., Farmingdale, NY
Structures, Structural Dynamics and Materials Conf., Proc. of 26th, held April 15-17, 1985, Orlando, FL, Spons. AIAA/ASME/ASCE/AHS, Part 1, pp 41-52, 12 figs, 6 tables, 15 refs

KEY WORDS: Fatigue life, Crack propagation, Computer programs

A combined crack growth and initiation method was developed to improve the predictive accuracy of damage tolerance analysis. The continuing damage at a location adjacent to the primary damage is realistically treated with fatigue crack initiation analysis in lieu of the assumed continuing damage size and location as stipulated in military specification MIL-A 83444.

85-2586

Cumulative Damage and Fatigue Life Prediction

T.V. Kutt, M.P. Bieniek
Columbia University, New York, NY
Structures, Structural Dynamics and Materials Conf., Proc. of 26th, held April 15-17, 1985, Orlando, FL, Spons. AIAA/ASME/ASCE/AHS, Part 1, pp 53-61, 7 figs, 23 refs

KEY WORDS: Fatigue life, Crack propagation, Damage prediction, Metals,

A cumulative damage rule is proposed for fatigue of metals under variable stress-amplitude loading. The rule is nonlinear and takes into account the sequence of stress levels; i.e., high-to-low or low-to-high changes of stress amplitudes. To facilitate probabilistic estimates of safety of structural elements subjected to fatigue loading, a stochastic model of fatigue damage is developed. The mean value and the variance of the fatigue life of an element are determined in terms of the statistics of the material properties and of the load parameters.

EXPERIMENTATION

MEASUREMENT AND ANALYSIS

85-2587

Effects of Structural Modes on Vibratory Force Determination by the Pseudo Inverse Technique

J.A. Fabunmi

Univ. of Maryland, College Park, MD
Structures, Structural Dynamics and Materials Conf., Proc. of 26th, held April 15-17, 1985, Orlando, Florida, spons. AIAA/ASME/ASCE/AHS, Part 2, pp 573-580, 5 figs, 3 tables, 13 refs

KEY WORDS: Force prediction, Mode shapes, Modal analysis, Linear theories, Beams

The accuracy and effectiveness of the pseudo inverse technique as a means of determining the operating vibratory loads on a structural system can be severely undermined, by lack of proper consideration of the participation of the structural modes at the frequency of interest. Methods of linear algebra and modal analysis are used to establish the limitations of this technique with regards to the number of independent forces determinable at a given frequency, in relation to the number and significance of structural modes participating in the response at that frequency.

85-2588

Digital Data Analysis Techniques for Extraction of Slosh Model Parameters

J.F. Unruh, D.D. Kana, F.T. Dodge, T.A. Fey

Southwest Res. Inst., San Antonio, TX
Structures, Structural Dynamics and Materials Conf., Proc. of 26th, held April 15-17, 1985, Orlando, Florida, spons. AIAA/ASME/ASCE/AHS, Part 2, pp 682-690, 7 figs, 2 tables, 5 refs

KEY WORDS: Modal analysis, Sloshing

Modern digital acquisition and modal analysis procedures are applied to the slosh

model parameter extraction problem with considerable success. After appropriate data conditioning to remove the tank rigid mass and liquid rigid mass from the spectral data, the slosh peaks are circle fit to obtain estimates of the pendulum's masses, damping, and pivot arm locations.

85-2589

Experimental Substructure Coupling with Rotational Coupling Coordinates

Yung-Tseng Chung, R.R. Craig, Jr.

Bell Helicopter, Textron, Inc., Fort Worth, TX

Structures, Structural Dynamics and Materials Conf., Proc. of 26th, held April 15-17, 1985, Orlando, Florida, spons. AIAA/ASME/ASCE/AHS, Part 2, pp 484-489, 6 figs, 2 tables, 8 refs

KEY WORDS: Modal analysis, Rotational mode shapes, Spline technique, Substructuring method

A substructure coupling method based on experimentally measured data, including rotational coupling coordinates, is presented.

The required rotational displacements at the interface are determined from the measured translational mode shapes by cubic spline interpolation. Simulation study shows that rotational mode shapes can be predicted accurately by the cubic spline interpolation using fewer translational frequency response function measurements than would be required by the finite difference method.

85-2590

Using Experimental Modal Modeling Techniques to Investigate Steering Column Vibration and Idle Shake of a Passenger Car

S.L. Chiang

Ford Motor Co.

Surface Vehicle Noise and Vibration Conf. Proc., Traverse City, MI, May 15-17, 1985. Spons. Society of Automotive Engineers, Warrendale, PA, pp 309-327

KEY WORDS: Experimental modal analysis, Automobile steering columns

An experimental modal model of an early prototype car was constructed and validated against test results. The model was then used to suggest practical hardware modification alternatives which would shift the steering column resonant frequency away from idle range, and maintain a low steering column tip vibration within the 600-750 RPM idle range. This model was also used to evaluate the effectiveness of tuning radiator mounts to the overall vehicle idle quality.

85-2591

Using Modal Analysis, Modeling and Analytical Modifications to Aid in the Development of Automotive Structures

D. Hauerperger

Structural/Kinematics

Surface Vehicle Noise and Vibration Conf. Proc., Traverse City, MI, May 15-17, 1985. Spons. Soc. of Automotive Engineers, Warrendale, PA, pp 303-307, 4 figs, 4 refs

KEY WORDS: Modal analysis, Motor vehicles

Modal Analysis has been advanced to the point where it can enable the user to select an optimum set of modifications that solve a problem analytically. There are three phases to an analysis of this type. The test parameters must be determined, the measurements must be taken, and the modal model (parameter estimation) is created. The concerns, techniques, requirements, and assumptions often forgotten when using modal analysis to generate a model of a structure, are addressed.

85-2592

Component Mode Synthesis for Structures with General Stiffness, Damping and Mass Matrices

K. Kubomura

Beloit Manhattan Inc., Clarks Summit, PA Structures, Structural Dynamics and Materials Conf., Proc. of 26th, held April 15-17, 1985, Orlando, Florida, spons. AIAA/ASME/ASCE/AHS, Part 2, pp 337-340, 3 refs

KEY WORDS: Component mode synthesis, Stiffness coefficients, Damping coefficients, Mass matrices

The component mode synthesis method for substructures with general rectangular forms of damping, stiffness and mass matrices is developed. For the development of reduction transformation equations, three aspects are discussed: the use of substructure modes of any frequency range; three different types of modes (free-free, cantilever and hybrid); the use of first and second order approximations. In this paper the reduction transformation equations for the use of lower frequency complex free-free and cantilever modes are presented.

85-2593

Development of an FM Multiplexed Telemetry System for Obtaining Dynamic Data from Operating Tank Track

C.W. Rodman, H.C. Meacham

Battelle-Columbus Labs.

Surface Vehicle Noise and Vibration Conf. Proc., Traverse City, MI, May 15-17, 1985. Spons. Soc. of Automotive Engineers, Warrendale, PA, pp 7-11, 5 figs

KEY WORDS: Data recorders, Measurement techniques, Tracked vehicles, Tanks (combat vehicles)

A system using FM multiplexed radio telemetry was developed and built to provide a data link between operating tank track and the tank hull. Field tests of the system showed that attention to details of the design of the antenna and battery system were successful in avoiding analytical problems.

85-2594

Obtaining Data to Determine the Effectiveness of Noise Controls

R.J. Goff, T.M. Lloyd

Safety and Health Technology Ctr.

Surface Vehicle Noise and Vibration Conf. Proc., Traverse City, MI, May 15-17, 1985, Spons. Soc. of Automotive Engineers, Warrendale, PA, pp 13-18, 6 figs, 1 table

KEY WORDS: Data recorders, Noise measurement, Mining equipment

In developing retrofit noise controls for mobile mining equipment, it is critical to document their effectiveness. The techniques used in gathering and analyzing data are described and a specific example is presented.

85-2595

A Concurrent Processing Implementation for Structural Vibration Analysis

S.W. Bostic, R.E. Fulton
NASA Langley Res. Ctr., Hampton, VA
Structures, Structural Dynamics and Materials Conf., Proc. of 26th, held April 15-17, 1985, Orlando, Florida, spon. AIAA/ASME/ASCE/AHS, Part 2, pp 566-572, 11 figs, 2 tables, 7 refs

KEY WORDS: Data processing, Natural frequencies, Mode shapes

A report on an investigation of a concurrent processing implementation of the inverse power method for obtaining vibration frequencies and mode shapes is presented, and its increase in computation speed relative to sequential computer implementation is assessed. Results are obtained for vibration test problems run on an eight-processor experimental computer.

85-2596

Optimization of an Electromechanical Signal Filter by Means of Holographic Interferometry (Optimierung eines elektromechanischen Signalfilters mittels holographischer Interferometrie)

P. Valenta, E. Schneider
Max-Planck-Institut für Metallforschung,
Stuttgart, Fed. Rep. Germany
Feinwerktech. u. Messtechn., 93 (2), pp 67-69
(Mar 1985), 5 figs, 4 refs (In German)

KEY WORDS: Holographic techniques, Vibration measurement, Optimization, Measurement techniques

The use of vibration holography enables the amplitude distribution on the surface of a

vibrating object to be rendered directly visible and measured. From this are derived numerous applications that can be utilized for industrial purposes. Vibration holography is used for recording the forms of natural vibration in components with complex geometry for optimization of components from vibration engineering aspects or for locating material faults. A report is given on the optimization of an electromechanical signal filter from vibration engineering aspects.

DYNAMIC TESTS

85-2597

New Acoustic Test Facilities of BMW

R. Eilker, N. Herzum, W. Keiner, A. Ulrich
BMW AG
Surface Vehicle Noise and Vibration Conf., Traverse City, MI, May 15-17, 1985. Spons. Soc. of Automotive Engineers, Warrendale, PA, pp 283-292, 11 figs, 1 ref

KEY WORDS: Test facilities, Automobiles, Motorcycles

New test standards for noise measurements on passenger cars and motorcycles are introduced. Information is given on room conditions, machinery equipment, sound levels, frequency ranges and types of measurement. Reports on initial experience with these test facilities are presented.

85-2598

Exploratory Flutter Test in a Cryogenic Wind Tunnel

S.R. Cole
NASA Langley Res. Ctr., Hampton, VA 23665
Structures, Structural Dynamics and Materials Conf., Proc. of 26th, held April 15-17, 1985, Orlando, Florida, spon. AIAA/ASME/ASCE/AHS, Part 2, pp 426-434, 17 figs, 2 tables, 9 refs

KEY WORDS: Flutter, Wind-tunnel testing, Aircraft wings

An experimental study to explore the feasibility of conducting flutter tests in cryogenic wind tunnels was conducted. The model used consisted of a rigid wing with an integral, flexible beam support that was cantilever mounted from the tunnel wall.

85-2599

Multimode Instability Prediction Method

K.E. Kadrnka

Rockwell International, El Segundo, CA
Structures, Structural Dynamics and Materials Conf., Proc. of 26th, held April 15-17, 1985, Orlando, Florida, spons. AIAA/ASME/ASCE/AHS, Part 2, pp 435-442, 19 figs, 8 refs

KEY WORDS: Flutter, Prediction techniques

The Zimmerman - Weissenburger method for prediction of flutter onset speed based on flight testing at subcritical speeds has been applied exclusively to a combination of two vibration modes. This process may therefore ignore a great deal of important information contained in other modes and their combinations. An extension of this method to incorporate more modes using standard stability criteria is presented.

DIAGNOSTICS

85-2600

Diagnosis and Prognosis of Turbomachinery Vibrations

H. Ming Chen, S.B. Malanoski

Mechanical Technology, Inc., Latham, NY
Rev. Tec. Ing., Univ. Zulia, Vol. 6, Edicion Especial, pp 111-131 (1983), 20 figs, 2 tables, 22 refs

KEY WORDS: Diagnostic techniques, Turbomachinery

A discussion on rotating equipment vibration problems - their occurrence, diagnosis by analytical and experimental methods, and a look to the future in this area, is presented.

85-2601

Building an Expert System to Diagnose Noise in Automotive Engine Cooling Systems

S.E. Dourson, J.D. Joyce

General Motors Corp., Kettering, OH
Surface Vehicle Noise and Vib. Conf. Proc., Traverse City, MI, May 15-17, 1985. Spons. Society of Automotive Engineers, Warrendale, PA, pp 19-26, 6 refs

KEY WORDS: Diagnostic techniques, Computer programs, Noise source identification, Engine noise, Cooling systems

The experiences of building a computer consultant to diagnose sources of noise in engine cooling systems are described. The emphasis is on identifying appropriate parameters and writing rules to codify the knowledge.

MONITORING

85-2602

Monitoring the Status of a Mechanical Cable While in Operation by Means of the Acoustic Emission Method

P.A.A. Laura, J.R. Matthews

Inst. of Applied Mechanics, Puerto Belgrano Naval Base, 8111 Argentina
Ocean Engrg., 12 (3), pp 211-219 (1985), 5 figs, 6 refs

KEY WORDS: Monitoring techniques, Acoustic emission, Cables

A brief review of research into failure mechanisms of various cables and the acoustic emission signature of the various cables under simulated loading is presented. The development of a specific operational monitor for a towed cable system is given.

ANALYSIS AND DESIGN

ANALYTICAL METHODS

85-2603

A Finite Element Method for Synthesis of Acoustical Shapes

R.J. Bernhard

Ray W. Herrick Labs., Purdue Univ., West Lafayette, IN

J. Sound Vib., 98 (1), pp 55-65 (Jan 8, 1985), 4 figs, 4 tables, 8 refs

KEY WORDS: Finite element technique, Optimization, Design techniques, Geometric effects, Acoustic properties

Classical finite element procedures are not well suited to the development of optimal acoustical shapes. Typical procedures require a complete analysis of each candidate acoustical geometry in the search for an optimal shape. A method is presented for decomposing the original finite element matrices which may be multiplied by shape change parameters to develop a model of the revised geometry. The method is also used to synthesize the geometry required for desired acoustical behavior of a complicated coupled cavity system.

85-2604

Vibration Analysis by Substructure Synthesis Method (Part 4, Calculation of Residual Compliance Matrix)

M. Ookuma, A. Nagamatsu

Tokyo Inst. of Technology, Tokyo, Japan
Bull. JSME, 28 (239), pp 905-910 (May 1985), 1 table, 5 refs

KEY WORDS: Substructuring methods, Structural synthesis

A method is proposed for accurately calculating the residual compliance matrix of structures with free-free boundary condition. Algorithms of the usual method and the method proposed by the authors as well as Hansteen are given and numerical examples of a simple case are shown.

85-2605

On the Oscillatory Instability of Multiple-Parameter Systems

A.S. Atadan, K. Huseyin

Univ. of Waterloo, Waterloo, Ontario, Canada

Intl. J. Engrg. Sci., 23 (8), pp 857-873 (1985), 5 figs, 30 refs

KEY WORDS: Stability, Balancing techniques

The postcritical oscillatory behavior of an autonomous discrete system under the influence of two independent parameters is studied. Three distinct situations are identified and explored via the intrinsic harmonic balancing technique. The asymptotic equations of the behavior surface in parameter-amplitude space are derived explicitly.

85-2606

Simple Approximants for Complex Linear Systems

J.L. Bogdanoff, F. Kozin

Purdue Univ., West Lafayette, IN

Structures, Structural Dynamics and Materials Conf., Proc. of 26th, held April 15-17, 1985, Orlando, Florida, spons. AIAA/ASME/ASCE/AHS, Part 2, pp 218-223, 2 figs, 8 refs

KEY WORDS: Approximation methods

A method is described for constructing a sequence of approximate systems of increasing complexity that can be employed to estimate the response of a complex linear system. Details of the method are sketched, and an example is briefly described.

85-2607

Time Series Approximation of Unsteady Aerodynamics Including Pole Locations as Free Parameters

L.D. Peterson, E.F. Crawley

Massachusetts Inst. of Technology, Cambridge, MA

Structures, Structural Dynamics and Materials Conf., Proc. of 26th, held April 15-17,

1985, Orlando, Florida, spons. AIAA/ASME/ASCE/AHS, Part 2, pp 251-257, 8 figs, 2 tables, 11 refs

KEY WORDS: Approximation methods, Aerodynamic loads, Time series analysis method

An algorithm has been developed to find exponential time series approximations to unsteady aerodynamic data at discrete frequencies using a least squares fit. The method differs from previous methods in that the pole locations of the exponential series approximation are explicitly included in the search, and that the fit simultaneously minimizes the error in both the real and imaginary parts of the approximation. A Newton-Raphson search algorithm is used to find the minimum of the weighted square error in the parameter space of the approximation while constraining the poles to be in the left half plane.

85-2608

On the Identification of Self-Adjoint Distributed Systems Using Modal Filters

H. Baruh, L.M. Silverberg
Rutgers Univ., New Brunswick, NJ
Structures, Structural Dynamics and Materials Conf., Proc. of 26th, held April 15-17, 1985, Orlando, Florida, spons. AIAA/ASME/ASCE/AHS, Part 2, pp 673-681, 9 figs, 3 tables, 15 refs

KEY WORDS: Continuous parameter method, Modal filters, Parameter identification techniques

A method is presented for the identification of external excitations acting on distributed-parameter systems and, for certain cases, the parameters contained in the equations of motion of the distributed system. By extracting the modal coordinates from the system output, and using these modal coordinates to identify the modal excitations acting on a number of modes, the actual external disturbances are synthesized. The effects of factors such as measurement noise and interpolation error are analyzed.

85-2609

Systematic Approach for Eigensensitivity Analysis

Shyi-Yaung Chen, Fu-Shang Wei
Kaman Aerospace Corp., Bloomfield, CT
Structures, Structural Dynamics and Materials Conf., Proc. of 26th, held April 15-17, 1985, Orlando, Florida, spons. AIAA/ASME/ASCE/AHS, Part 2, pp 178-183, 10 refs

KEY WORDS: Eigenvalue problems, Stability, Flutter, System identification techniques

Based on the matrix decomposition and generalized inverse technique, a method for the determination of the sensitivity of the eigenvalues and eigenvectors of nth order eigensystem, with respect to system design parameters, has been developed. This method requires knowledge of only one eigenvalue and its associated right and left eigenvectors which, together with information from the matrix column and null space, will lead to the eigenvalue and eigenvector derivative of a physical problem, such as stability analysis, flutter analysis, and system identification. Two different approaches and numerical procedures are utilized.

85-2610

On the Design Derivatives of Eigenvalues and Eigenvectors for Distributed Parameter Systems

R. Reiss
Howard Univ., Washington, D.C.
Structures, Structural Dynamics and Materials Conf., Proc. of 26th, held April 15-17, 1985, Orlando, Florida, spons. AIAA/ASME/ASCE/AHS, Part 2, pp 173-177, 9 refs

KEY WORDS: Eigenvalue problems, Continuous parameter method

Analytic expressions are obtained for the design derivatives of eigenvalues and eigenfunctions of self-adjoint linear distributed parameter system. Explicit treatment of boundary conditions is avoided by casting the eigenvalue equation into integral form. Results are expressed in terms of the linear operators defining the eigenvalue problem,

and are therefore quite general. Sufficiency conditions appropriate to structural optimization of eigenvalues are obtained.

85-2611

The h-Version and p-Version of the Finite Element Method and the Inclusion Principle
L. Meirovitch, J.K. Bennighof
Virginia Polytechnic Inst. and State Univ., Blacksburg, VA

Structures, Structural Dynamics and Materials Conf., Proc. of 26th, held April 15-17, 1985, Orlando, Florida, spons. AIAA/ASME/ASCE/AHS, Part 2, pp 691-698, 5 figs, 14 refs

KEY WORDS: Eigenvalue problems, Finite element technique

In the classical Rayleigh-Ritz method, improvement in the computed eigenvalues can be obtained by increasing the number of terms in the series expansion. The matrices defining the discrete eigenvalue problem possess the embedding property, in the sense that the matrix A corresponding to $n + 1$ terms is obtained from the matrix B corresponding to n terms by adding one row and the corresponding column. The computed eigenvalues satisfy the inclusion principle, which states that the eigenvalues of A bracket the eigenvalues of B. This paper examines how the inclusion principle relates to various elements and refinement strategies in the finite element method.

MODELING TECHNIQUES

85-2612

The Finite Element Modeling of the Free Vibration of a Read/Write Head Floppy Disk System

J.K. Good, R.L. Lowery
Oklahoma State Univ., Stillwater, OK
J. Vib., Acoust., Stress Rel. Des., Trans. ASME, 107 (3), pp 329-333 (July 1985), 14 figs, 11 refs

KEY WORDS: Computer storage devices, Vibration control, Design techniques, Finite element techniques

The configuration of read/write head designs in floppy disk drive units is of importance as some designs witness vibration phenomena which lead to signal loss and excessive wearing of the disk media. This paper presents finite element modeling, and results of a read/write head floppy disk system in free vibration. The objective of this work is to determine the design parameters of read/write head support structure which will reduce vibration phenomena.

PARAMETER IDENTIFICATION

85-2613

Identifying Approximate Linear Models for Simple Nonlinear Systems

L.C. Horta, Jer-Nan Juang
NASA Langley Res. Ctr., Hampton, VA
Structures, Structural Dynamics and Materials Conf., Proc. of 26th, held April 15-17, 1985, Orlando, Florida, spons. AIAA/ASME/ASCE/AHS, Part 2, pp 282-289, 6 figs, 2 tables, 8 refs

KEY WORDS: Parameter identification technique

The identification of approximate linear models from response data for certain nonlinear dynamic systems is addressed. Response characteristics for several typical nonlinear joints are analyzed mathematically and represented by series expansions. The parameters of the series expansion are then compared with the modal parameters of a linear model identified by the Eigensystem realization algorithm.

DESIGN TECHNIQUES

85-2614

Dynamic Condensation for Structural Redesign

Ki-Ook Kim
Automated Analysis Corp., Ann Arbor, MI

Structures, Structural Dynamics and Materials Conf., Proc. of 26th, held April 15-17, 1985, Orlando, Florida, spons. AIAA/-ASME/ASCE/AHS, Part 2, pp 379-383, 4 figs, 6 tables, 6 refs

KEY WORDS: Design techniques, Dynamic condensation method, Structural modification techniques, Natural frequency, Mode shapes

A structural redesign method using dynamic condensation is presented for frequency and mode shape changes of undamped structural systems. The equilibrium equation of the perturbed system includes nonlinear perturbations from a baseline design which are solved in an iterative procedure. The physical degrees of freedom are divided into master and slave sets. The method is simple and effective.

COMPUTER PROGRAMS

85-2615
Software System for Fatigue Life Calculation

M. Hanke, B. Kurz
Motor Car Res. Inst., UVMV, Prague, Czechoslovakia
Vehicle Structures, Intl. Conf., IMechE., London, Conf. Pub. 1984-7, SAE-MEP 200, pp 109-113, 4 figs, 11 refs

KEY WORDS: Computer programs, Fatigue life

Three main groups of the known cumulative damage calculation procedures are included in the described new subsystem ZIVOT; i.e., LIFE being built as part of a software system SADKO for evaluation of the continuous analog signals represented digitally by means of A/D converters.

GENERAL TOPICS

CONFERENCE PROCEEDINGS

85-2616

Internoise 84. International Cooperation for Noise Control

Proc. Intl. Conf. on Noise Control Engrg., Honolulu, Hawaii, Dec. 3-5, 1984, 2 Vols.

KEY WORDS: Noise control, Proceedings

The papers in these volumes cover the entire field of noise control engineering. A number of papers on the physical aspects of environmental noise, especially community noise control are included. Several papers on the subject of sound intensity are also presented.

CRITERIA, STANDARDS AND SPECIFICATIONS

85-2617

MIL-STD-810D vs. MIL-STD-810C - A Detailed Summary and Comparison. Part II: Method 514

H. Caruso
J. Environ. Sci., 28 (3), pp 47-52 (May/June 1985), 5 tables

KEY WORDS: Standards, Testing techniques, Vibration testing

A side-by-side comparison of the significant features of MIL-STD-810D and MIL-STD-810C, environmental test methods and engineering guidelines is presented. Included are details related to general test tailoring policy and application, test environments, and test facilities.

USEFUL APPLICATIONS

85-2618

Vibration-Random Required

J.D. McGrath, W. Kindig

General Electric Co.

J. Environ. Sci., **28** (3), pp 36-40 (May/June 1985), 8 figs, 6 tables, 5 refs

KEY WORDS: Random vibrations, Screening, Testing techniques

An approach to hardware screening using random vibration as a stimulus is presented. The proposed techniques were developed to achieve a screening program that is cost effective and is supportable in dollar payoff with increased productivity. Cost savings are realized by avoiding the assignment of a costly combined environment facility to each product line and reducing the number of test cycles required in the screening process.

PERIODICALS SCANNED

ACTA MECHANICA

(Acta Mech.)

Springer-Verlag New York, Inc.
175 Fifth Ave.
New York, NY 10010

ACUSTICA

(Acustica)

S. Hirzel Verlag, Postfach 40
7000 Stuttgart 1
Fed. Rep. Germany

AERONAUTICAL JOURNAL

(Aeronaut. J.)

Royal Aeronautical Society
4 Hamilton Pl.
London W1V 0BQ, UK

AIAA JOURNAL

(AIAA J.)

American Institute of Aeronautics
and Astronautics
1633 Broadway
New York, NY 10019

**AMERICAN SOCIETY OF CIVIL ENGINEERS,
PROCEEDINGS**

(ASCE, Proc.)

ASCE
United Engineering Center
345 E. 47th St.
New York, NY 10017

JOURNAL OF ENGINEERING MECHANICS

(ASCE J. Engrg. Mech.)

JOURNAL OF STRUCTURAL ENGINEERING

(ASCE J. Struc. Engrg.)

**AMERICAN SOCIETY OF LUBRICATION ENGINEERS,
TRANSACTIONS**

(ASLE, Trans.)

ASLE
838 Busse Highway
Park Ridge, IL 60068

**AMERICAN SOCIETY OF MECHANICAL ENGINEERS,
TRANSACTIONS**

(Trans. ASME)

ASME
United Engineering Center
345 E. 47th St.
New York, NY 10017

JOURNAL OF APPLIED MECHANICS
(J. Appl. Mech., Trans. ASME)

**JOURNAL OF DYNAMIC SYSTEMS,
MEASUREMENT AND CONTROL**
(J. Dynam. Syst., Meas. Control, Trans. ASME)

JOURNAL OF ENERGY RESOURCES TECHNOLOGY
(J. Energy Resources Tech., Trans. ASME)

JOURNAL OF ENGINEERING FOR INDUSTRY
(J. Engrg. Indus., Trans. ASME)

JOURNAL OF ENGINEERING FOR GAS TURBINES AND POWER
(J. Engrg. Gas Turbines Power, Trans. ASME)

JOURNAL OF PRESSURE VESSEL TECHNOLOGY
(J. Pressure Vessel Tech., Trans. ASME)

JOURNAL OF TRIBOLOGY
(J. Trib., Trans. ASME)

**JOURNAL OF VIBRATION, ACOUSTICS,
STRESS, AND RELIABILITY IN DESIGN**
(J. Vib., Acoust., Stress, Rel. Des., Trans. ASME)

APPLIED ACOUSTICS

(Appl. Acoust.)

Applied Science Publishers,
Ltd.
Ripple Road,
Barking, Essex, UK

AUTOMOBILTECHNISCHE ZEITSCHRIFT
(Automobiltech. Z.)
Franckh'sche Verlagshandlung
Abteilung Technik
7000 Stuttgart 1
Pfizerstrasse 5-7
Fed. Rep. Germany

AUTOMOTIVE ENGINEER (UK)
(Auto. Engr. (UK))
Mechanical Engineering Publica-
tions Ltd.
P.O. Box 24
Northgate Ave., Bury St.
Edmunds
Suffolk IP32 6BW, UK

AUTOMOTIVE ENGINEERING (SAE)
(Auto. Engrg. (SAE))
Society of Automotive Engi-
neers, Inc.
400 Commonwealth Dr.
Warrendale, PA 15096

**BALL BEARING JOURNAL (English
Edition)**
(Ball Bearing J.)
SKF (UK) Ltd.
Luton, Bedfordshire
LU3 3BL, UK

BROWN BOVERI REVIEW
(Brown Boveri Rev.)
Brown Boveri and Co., Ltd.
CH-5401, Baden, Switzerland

**BULLETIN OF JAPAN SOCIETY OF
MECHANICAL ENGINEERS**
(Bull. JSME)
Japan Society of Mechanical
Engineers
Sanshin Hokusei Bldg.
H-9 Yoyogi 2-chome Shibuya-ku
Tokyo 151, Japan

**BULLETIN OF SEISMOLOGICAL SOCIETY
OF AMERICA**
(Bull. Seismol. Soc. America)
P.O. Box 826
Berkeley, CA 94705

**CANADIAN JOURNAL OF CIVIL ENGI-
NEERING**
(Can. J. Civ. Engrg.)
National Research Council of
Canada
Ottawa, Canada K1A 0R6

CHARTERED MECHANICAL ENGINEER
(Chart. Mech. Engr.)
Institution of Mechanical
Engineers
P.O. Box 24
Northgate Ave., Bury St.
Edmunds
Suffolk IP32 6BW, UK

**CHINA SCIENCE AND TECHNOLOGY
ABSTRACTS**
(China Sci. Tech. Abstracts)
International Information
Service Ltd.
P.O. Box 24683
ABD Post Office, Hong Kong

CIVIL ENGINEERING (NEW YORK)
(Civ. Engrg. (NY))
ASCE
United Engineering Center
345 E. 47th St.
New York, NY 10017

COMPRESSED AIR
(Compressed Air)
253 E. Washington Ave.
Washington, NJ 07882-2495

COMPUTERS AND STRUCTURES
(Computers Struc.)
Pergamon Press Inc.
Maxwell House, Fairview Park
Elmsford, NY 10523

**COMPUTERS IN MECHANICAL ENGINEER-
ING**
(Computers Mech. Engrg.)
ASME
United Engineering Center
345 E. 47th St.
New York, NY 10017

DESIGN NEWS
(Des. News)
Cahners Publishing Co., Inc.
221 Columbus Ave.
Boston, MA 02116

DIESEL PROGRESS
(Diesel Prog.)
Diesel Progress
13555 Bishop's Ct.
Brookfield, WI 53035

EARTHQUAKE ENGINEERING AND STRUCTURAL DYNAMICS

(Earthquake Engrg. Struc. Dynam.)
John Wiley and Sons Ltd.
Baffins Lane
Chichester, Sussex PO19 1UD,
England

ELECTRONIC PRODUCTS

(Electronic Prod.)
Hearst Business Communications,
Inc.
P.O. Box 730
Garden City, NY 11530

ENGINEERING STRUCTURES

(Engrg. Struc.)
IPC Science and Technology
Press Ltd.
Westbury House
P.O. Box 63, Bury St.
Guildford, Surrey GU2 5BH, UK

EXPERIMENTAL MECHANICS

(Exptl. Mech.)
Society for Experimental Stress
Analysis
14 Fairfield Dr.
Brookfield Center, CT 06805

EXPERIMENTAL TECHNIQUES

(Exptl. Tech.)
Society for Experimental Stress
Analysis
14 Fairfield Dr.
Brookfield Center, CT 06805

FEINGERÄTETECHNIK

(Feingerätetechnik)
VEB Verlag Technik
Berlin,
German Dem. Rep.

FEINWERKTECHNIK UND MESSTECHNIK

(Feinwerktech. u. Messtech.)
Carl Hanser Verlag
Postfach 860420
D-8000 München 86
Fed. Rep. Germany

FORSCHUNG IN INGENIEURWESEN

(Forsch. Ingenieurwesen)
Verein Deutscher Ingenieur,
GmbH
Postfach 1139, Graf-Recke Str. 84
4 Düsseldorf 1,
Fed. Rep. Germany

GUMMI ASBEST KUNSTSTOFFE

(Gummi Asbest Kunstst.)
A.W. Gentner Verlag GmbH and
Co. KG
Forstrasse 131, Postfach 688
7000 Stuttgart,
Fed. Rep. Germany

HEATING/PIPING/AIR CONDITIONING

(Heating/Piping/Air Cond.)
Circulation Dept.
614 Superior Ave. West
Cleveland, OH 44113

HIGH TECHNOLOGY

(High Tech.)
Subscription Service Dept.
P.O. Box 2528
Boulder, CO 80322

HYDRAULICS AND PNEUMATICS

(Hydraul. Pneumat.)
Penton/IPC, Inc.
614 Superior Ave. West
Cleveland, OH 44113

HYDROCARBON PROCESSING

(Hydrocarbon Processing)
Gulf Publishing Co.
P.O. Box 2608
Houston, TX 77001

IBM JOURNAL OF RESEARCH AND DEVELOPMENT

(IBM J. Res. Dev.)
International Business Machines
Corp.
Armonk, NY 10504

**INDUSTRIAL LUBRICATION AND TRIB-
OLOGY**

(Indus. Lubric. Trib.)
Peterson Publishing Co. Ltd.
Peterson House, Northbank,
Berryhill Industrial Estate
Droitwich, Worcs WR9 9BL,
England

INGENIEUR-ARCHIV

(Ing.-Arch.)
Springer-Verlag New York, Inc.
44 Hartz Way
Secaucus, NJ 07094

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS, PROCEEDINGS
(IEEE, Proc.)
IEEE
United Engineering Center
345 E. 47th St.
New York, NY 10017

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS, TRANSACTIONS
(IEEE, Trans.)
445 Hoes Lane
Piscataway, NJ 08854

INDUSTRIAL ELECTRONICS
(Indus. Electronics)

INDUSTRY APPLICATIONS
(Indus. Applic.)

INSTRUMENTATION AND MEASUREMENT
(Instrum. Meas.)

POWER APPARATUS AND SYSTEMS
(Power Apparatus Syst.)

SONICS AND ULTRASONICS
(Sonics Ultrasonics)

VEHICULAR TECHNOLOGY
(Vehicular Tech.)

INSTITUTE OF MARINE ENGINEERS, TRANSACTIONS (TM)
(Inst. Marine Engr., Trans. (TM))
Institute of Marine Engineers
76 Mark Lane
London EC3R 7JN, UK

INSTITUTION OF MECHANICAL ENGINEERS, PROCEEDINGS, PART C: MECHANICAL ENGINEERING SCIENCE
(IMEchE, Proc.)
Institution of Mechanical Engineers
1 Birdcage Walk, Westminster,
London SW1, UK

INSTRUMENT SOCIETY OF AMERICA, TRANSACTIONS
(ISA, Trans.)
Instrument Society of America
67 Alexander Dr.
Research Triangle Park, NC
27709

INSTRUMENTATION TECHNOLOGY
(Instrum. Tech.)
Instrument Society of America
67 Alexander Dr.
P.O. Box 12277
Research Triangle Park, NC
27709

INTERNATIONAL JOURNAL OF CONTROL
(Intl. J. Control)
Taylor and Francis Ltd.
10-14 Macklin St.
London WC2B 5NF, UK

INTERNATIONAL JOURNAL OF ENGINEERING SCIENCE
(Intl. J. Engrg. Sci.)
Pergamon Press Inc.
Maxwell House, Fairview Park
Elmsford, NY 10523

INTERNATIONAL JOURNAL OF FATIGUE
(Intl. J. Fatigue)
Butterworth Scientific Ltd.
Journals Div.
P.O. Box 63, Westbury House,
Bury St.
Guildford GU2 5BH, Surrey, UK

INTERNATIONAL JOURNAL OF IMPACT ENGINEERING
(Intl. J. Impact Engrg.)
Pergamon Press Inc.
Maxwell House, Fairview Park
Elmsford, NY 10523

INTERNATIONAL JOURNAL OF MACHINE TOOL DESIGN AND RESEARCH
(Intl. J. Mach. Tool Des. Res.)
Pergamon Press Inc.
Maxwell House, Fairview Park
Elmsford, NY 10523

INTERNATIONAL JOURNAL OF MECHANICAL SCIENCES
(Intl. J. Mech. Sci.)
Pergamon Press Inc.
Maxwell House, Fairview Park
Elmsford, NY 10523

INTERNATIONAL JOURNAL OF NON-LINEAR MECHANICS
(Intl. J. Nonlin. Mech.)
Pergamon Press Inc.
Maxwell House, Fairview Park
Elmsford, NY 10523

INTERNATIONAL JOURNAL FOR NUMERICAL AND ANALYTICAL METHODS IN GEOMECHANICS

(Intl. J. Numer. Anal. Methods Geomech.)

John Wiley and Sons Ltd.
Baffins Lane
Chichester, Sussex PO19 1UD,
England

INTERNATIONAL JOURNAL FOR NUMERICAL METHODS IN ENGINEERING

(Intl. J. Numer. Methods Engrg.)

John Wiley and Sons Ltd.
Baffins Lane
Chichester, Sussex PO19 1UD,
England

INTERNATIONAL JOURNAL OF SOLIDS AND STRUCTURES

(Intl. J. Solids Struc.)

Pergamon Press Inc.
Maxwell House, Fairview Park
Elmsford, NY 10523

INTERNATIONAL JOURNAL OF VEHICLE DESIGN

(Intl. J. Vehicle Des.)

Inderscience Enterprises Ltd.
World Trade Center Building
110 Avenue Louis Casai
Case Postale 306
CH-1215 Geneva
Aéroport, Switzerland

ISRAEL JOURNAL OF TECHNOLOGY

(Israel J. Tech.)

Weizmann Science Press of
Israel
Box 801
Jerusalem, Israel

JOURNAL OF THE ACOUSTICAL SOCIETY OF AMERICA

(J. Acoust. Soc. Amer.)

American Institute of Physics
335 E. 45th St.
New York, NY 10017

JOURNAL OF AIRCRAFT

(J. Aircraft)

American Institute of Aeronautics and Astronautics
1633 Broadway
New York, NY 10019

JOURNAL OF ENVIRONMENTAL SCIENCES

(J. Environ. Sci.)

Institute of Environmental
Sciences
940 E. Northwest Highway
Mt. Prospect, IL 60056

JOURNAL OF THE FRANKLIN INSTITUTE

(J. Franklin Inst.)

Pergamon Press Inc.
Maxwell House, Fairview Park
Elmsford, NY 10523

JOURNAL DE MÉCANIQUE THÉORIQUE ET APPLIQUÉE

(J. de Mécanique Théor. Appl.)

Gauthier-Villars
C.D.R. - Centrale des Revues
11, rue Gossin, 92543 Mon-
trouge, Cedex, France

JOURNAL OF PETROLEUM TECHNOLOGY

(J. Pet. Tech.)

Society of Petroleum Engineers
6200 N. Central Expressway
Dallas, TX 75206

JOURNAL OF PHYSICS, E: SCIENTIFIC INSTRUMENTS

(J. Phys., E: Sci. Instrum.)

American Institute of Physics
335 E. 45th St.
New York, NY 10017

JOURNAL OF SHIP RESEARCH

(J. Ship Res.)

Society of Naval Architects and
Marine Engineers
One World Trade Center
Suite 1369
New York, NY 10048

JOURNAL OF SOUND AND VIBRATION

(J. Sound Vib.)

Academic Press Inc.
111 Fifth Ave.
New York, NY 10003

JOURNAL OF SPACECRAFT AND ROCKETS

(J. Spacecraft Rockets)

American Institute of Aeronautics and Astronautics
1633 Broadway
New York, NY 10019

JOURNAL OF STRUCTURAL MECHANICS
(J. Struc. Mech.)
Marcel Dekker, Inc.
270 Madison Ave.
New York, NY 10016

KONSTRUKTION
(Konstruktion)
Springer-Verlag
3133 Connecticut Ave., N.W.,
Suite 712
Washington, DC 20008

LUBRICATION ENGINEERING
(Lubric. Engrg.)
American Society of Lubrication
Engineers
838 Busse Highway
Park Ridge, IL 60068

MACHINE DESIGN
(Mach. Des.)
Penton/IPC, Inc.
Penton Plaza,
1111 Chester Ave.
Cleveland, OH 44114

MASCHINENBAUTECHNIK
(Maschinenbautech.)
VEB Verlag Technik
Oranienburger Str. 13/14
1020 Berlin,
German Dem. Rep.

MECCANICA
(Meccanica)
Pergamon Press Inc.
Maxwell House, Fairview Park
Elmsford, NY 10523

MECHANICAL ENGINEERING
(Mech. Engrg.)
American Society of Mechanical
Engineers
United Engineering Center
345 E. 47th St.
New York, NY 10017

MECHANICS RESEARCH COMMUNICATIONS
(Mech. Res. Comm.)
Pergamon Press Inc.
Maxwell House, Fairview Park
Elmsford, NY 10523

MECHANISM AND MACHINE THEORY
(Mech. Mach. Theory)
Pergamon Press Inc.
Maxwell House, Fairview Park
Elmsford, NY 10523

MICROTECNIC
(Microtecnie)
Agifa Verlag
Universitätstrasse 94
P.O. Box 257
CH-8033 Zürich, Switzerland

NTZ MOTORTECHNISCHE ZEITSCHRIFT
(NTZ Motortech. Z.)
Franckh'sche Verlagshandlung
Pfizerstrasse 5-7
7000 Stuttgart 1,
Fed. Rep. Germany

NAVAL ENGINEERS JOURNAL
(Naval Engr. J.)
American Society of Naval
Engineers, Inc.
1012 14th St., N.W.
Suite 507, Continental Bldg.
Washington, DC 20005

NDT INTERNATIONAL
(NDT Intl.)
Butterworth Scientific Ltd.
Journals Div.
P.O. Box 63, Westbury House,
Bury St.
Guildford, Surrey GU2 5BH, UK

NOISE CONTROL ENGINEERING JOURNAL
(Noise Control Engrg. J.)
P.O. Box 2306, Arlington Branch
Poughkeepsie, NY 12603

NUCLEAR ENGINEERING AND DESIGN
(Nucl. Engrg. Des.)
North-Holland Publishing Co.
P.O. Box 1000 AC
Amsterdam, The Netherlands

OCEAN ENGINEERING
(Ocean Engrg.)
Pergamon Press Inc.
Maxwell House, Fairview Park
Elmsford, NY 10523

PAPER TECHNOLOGY AND INDUSTRY
(Paper Tech. Indus.)
3, Plough Place, Fetter Lane
London EC4A 1AL, UK

PLANT ENGINEERING**(Plant Engrg.)**

Technical Publishing Co.
1301 S. Grove Ave.
Barrington, IL 60010

POWER**(Power)**

P.O. Box 430
Hightstown, NJ 08520

POWER TRANSMISSION DESIGN**(Power Transm. Des.)**

1111 Chester Ave.
Cleveland, OH 44114

**QUARTERLY JOURNAL OF MECHANICS
AND APPLIED MATHEMATICS****(Quart. J. Mech. Appl. Math.)**

Wm. Dawson and Sons, Ltd.
Cannon House
Folkestone, Kent, UK

**REVUE ROUMAINE DES SCIENCES
TECHNIQUES, SERIE DE MECANIQUE
APPLIQUEE****(Rev. Roumaine Sci. Tech., Mecan-
ique Appl.)**

Editions de l'Academie
de la Republique Socialiste de
Roumaine
3 Bis Str., Gutenberg, Bucha-
rest, Romania

REVIEW OF SCIENTIFIC INSTRUMENTS**(Rev. Scientific Instrum.)**

American Institute of Physics
335 E. 45th St.
New York, NY 10017

**SAE TECHNICAL LITERATURE AB-
STRACTS****(SAE Tech. Lit. Abstracts)**

Society of Automotive Engineers
400 Commonwealth Dr.
Warrendale, PA 15086

SCIENTIFIC AMERICAN**(Scientific American)**

415 Madison Ave.
New York, NY 10017

SHOCK AND VIBRATION DIGEST**(Shock Vib. Dig.)**

Shock and Vibration Information
Center
Naval Research Laboratory, Code
5804
Washington, DC 20375

SIAM JOURNAL ON APPLIED MATHEMATICS**(SIAM J. Appl. Math.)**

Society for Industrial and
Applied Mathematics
1405 Architects Building
117 S. 17th St.
Philadelphia, PA 19103

**SIEMENS RESEARCH AND DEVELOPMENT
REPORTS****(Siemens Res. Dev. Repts.)**

Springer-Verlag New York Inc.
175 Fifth Ave.
New York, NY 10010

STROJNICKY CASOPIS**(Strojnický Časopis)**

Redakcia Strojnickeho Časopisu
ČSAV aSAV
Ustav Mechaniky Strojov SAV
Bratislava-Patronka, Dúbravská
cesta, ČSSR, Czechoslovakia

S/V, SOUND AND VIBRATION**(S/V, Sound Vib.)**

Acoustic Publications, Inc.
27101 E. Oviatt Rd.
P.O. Box 40416
Bay Village, OH 44140

TAPPI JOURNAL**(Tappi J.)**

Technical Association of the
Pulp and Paper Industry
15 Technology Park South
Norcross, GA 30092

TECHNICAL REVIEW (B and K)**(Tech. Rev. (B and K))**

Bruel and Kjaer
185 Forest St.
Marlborough, MA 01752

**TECHNISCHE MITTEILUNGEN KRUPP,
FORSCHUNGSBERICHTE**
(Techn. Mitt. Krupp, Forschungsber.)

Krupp Gemeinschaftsbetriebe,
Fachbücherei, Postfach 10 19
52, D-4300 Essen 1,
Fed. Rep. Germany

**TECHNISCHE MITTEILUNGEN KRUPP,
WERKSBERICHTE**
(Techn. Mitt. Krupp, Werksber.)

Krupp Gemeinschaftsbetriebe,
Fachbücherei, Postfach 10 19
52, D-4300 Essen 1,
Fed. Rep. Germany

TECHNISCHES MESSEN-TM
(Techn. Messen-TM)

R. Oldenbourg Verlag GmbH
Rosenheimer Strasse 145, 8000
München 80, Fed. Rep. Germany

TEST
(Test)

Mattingley Publishing Co., Inc.
61 Monmouth Rd.
Oakhurst, NJ 07755

TRIBOLOGY INTERNATIONAL
(Trib. Intl.)

Butterworth Scientific Ltd.
Journals Div.
P.O. Box 63, Westbury House,
Bury St.
Guildford, Surrey GU2 5BH, UK

TURBOMACHINERY INTERNATIONAL
(Turbomachinery Intl.)

270 Madison Ave.
New York, NY 10016

VDI BERICHTE
(VDI Ber.)

Verein Deutscher Ingenieur GmbH
Postfach 1139, Graf-Recke Str.
84, 4 Düsseldorf 1,
Fed. Rep. Germany

VDI FORSCHUNGSHEFT
(VDI Forsch.)

Verein Deutscher Ingenieur GmbH
Postfach 1139, Graf-Recke Str.
84, 4 Düsseldorf 1,
Fed. Rep. Germany

VDI ZEITSCHRIFT
(VDI Z.)

Verein Deutscher Ingenieur GmbH
Postfach 1139, Graf-Recke Str.
84, 4 Düsseldorf 1,
Fed. Rep. Germany

VEHICLE SYSTEM DYNAMICS
(Vehicle Syst. Dynam.)

Swets and Zeitlinger B.V.
Publishing Dept.
347 B, Heereweg, 2161 Ca Lisse,
The Netherlands

VERTICA
(Vertica)

Pergamon Press
Maxwell House, Fairview Park
Elmsford, NY 10523

VIBROTECHNIKA
(Vibrotechnika)

Kauno Polytechnikos Institutas
2 Donelaičio g-ve 17
233000 Kaunas,
Lithuanian SSR

WAVE MOTION
(Wave Motion)

Elsevier Science Publishers
Molenwerf 1, P.O. Box 1991
1000 BZ Amsterdam,
The Netherlands

WEAR
(Wear)

Elsevier-Sequoia S.A.
P.O. Box 851
1001 Lausanne 1,
Switzerland

**ZEITSCHRIFT FÜR ANGEWANDTE MATHE-
MATIK UND MECHANIK**

(Z. angew. Math. Mech.)
Akademie Verlag GmbH
Liepziger Str. 3-4
108 Berlin,
German Dem. Rep.

**ZEITSCHRIFT FÜR FLUGWISSEN-
SCHAFTEN UND WELTRAUMFORSCHUNG**
(Zt. f. Flugwiss. u. Weltraum-
forsch.)

DFVLR
D-3300 Braunschweig
Flughafen, Postfach 3267,
Fed. Rep. Germany

SECONDARY PUBLICATIONS SCANNED

DISSERTATION ABSTRACTS INTERNATIONAL

(DA)

University Microfilms International
300 N. Zeeb Rd.
Ann Arbor, MI 48106

GOVERNMENT REPORTS ANNOUNCEMENTS AND INDEX

(GRA)

National Technical Information Service
U.S. Department of Commerce
5285 Port Royal Rd.
Springfield, VA 22161

PROCEEDINGS SCANNED

INTER-NOISE PROCEEDINGS, INTERNATIONAL CONFERENCE ON NOISE CONTROL ENGINEERING

(Inter-Noise)

Noise Control Foundation
P.O. Box 3469, Arlington Branch
Poughkeepsie, NY 12603

MACHINERY VIBRATION MONITORING AND ANALYSIS MEETING, PROCEEDINGS (Mech. Vib. Monit. Anal., Proc.)

The Vibration Institute
101 W. 55th St., Suite 206
Clarendon Hills, IL 60514

NOISE CONTROL PROCEEDINGS, NATIONAL CONFERENCE ON NOISE CONTROL ENGINEERING

(Noise Control)

Noise Control Foundation
P.O. Box 3469, Arlington Branch
Poughkeepsie, NY 12603

THE SHOCK AND VIBRATION BULLETIN, UNITED STATES NAVAL RESEARCH LABORATORIES, ANNUAL PROCEEDINGS (Shock Vib. Bull., U.S. Naval Res. Lab., Proc.)

Shock and Vibration Information Center
Naval Research Lab., Code 5804
Washington, DC 20375

TURBOMACHINERY SYMPOSIUM (Turbomachinery Symp.)

Gas Turbine Labs.
Texas A and M University
College Station, TX 77843

ABSTRACT CATEGORIES

MECHANICAL SYSTEMS

Rotating Machines
Reciprocating Machines
Power Transmission Systems
Metal Working and Forming
Isolation and Absorption
Electromechanical Systems
Optical Systems
Materials Handling
Equipment

STRUCTURAL SYSTEMS

Bridges
Buildings
Towers
Foundations
Underground Structures
Harbors and Dams
Roads and Tracks
Construction Equipment
Pressure Vessels
Power Plants
Off-shore Structures

VEHICLE SYSTEMS

Ground Vehicles
Ships
Aircraft
Missiles and Spacecraft

BIOLOGICAL SYSTEMS

Human
Animal

MECHANICAL COMPONENTS

Absorbers and Isolators
Springs
Tires and Wheels

Blades
Bearings
Belts
Gears
Clutches
Couplings
Fasteners
Linkages
Valves
Seals
Cams

STRUCTURAL COMPONENTS

Strings and Ropes
Cables
Bars and Rods
Beams
Cylinders
Columns
Frames and Arches
Membranes, Films, and Webs
Panels
Plates
Shells
Rings
Pipes and Tubes
Ducts
Building Components

ELECTRIC COMPONENTS

Controls (Switches,
Circuit Breakers
Motors
Generators
Transformers
Relays
Electronic Components

DYNAMIC ENVIRONMENT

Acoustic Excitation
Shock Excitation

Vibration Excitation
Thermal Excitation

MECHANICAL PROPERTIES

Damping
Fatigue
Elasticity and Plasticity
Wave Propagation

EXPERIMENTATION

Measurement and Analysis
Dynamic Tests
Scaling and Modeling
Diagnostics
Balancing
Monitoring

ANALYSIS AND DESIGN

Analogs and Analog
Computation
Analytical Methods
Modeling Techniques
Nonlinear Analysis
Numerical Methods
Statistical Methods
Parameter Identification
Mobility/Impedance Methods
Optimization Techniques
Design Techniques
Computer Programs

GENERAL TOPICS

Conference Proceedings
Tutorials and Reviews
Criteria, Standards, and
Specifications
Bibliographies
Useful Applications

TECHNICAL NOTES

D.T. Horak

A Simplified Modeling and Computational Scheme for Manipulator Dynamics

J. Dynam. Syst., Meas. Control, Trans. ASME, 106 (4), pp 350-353 (Dec 1984), 4 figs, 6 refs

Chyi Hwang

Mixed Method of Routh and ISE Criterion Approaches for Reduced-Order Modeling of Continuous-Time Systems

J. Dynam. Syst., Meas. Control, Trans. ASME, 106 (4), pp 353-356 (Dec 1984), 2 figs, 1 table, 11 refs

D. Karnopp

Computer Simulation of Stick-Slip Friction in Mechanical Dynamic Systems

J. Dynam. Syst., Meas. Control, Trans. ASME, 107 (1), pp 100-103 (Mar 1985), 6 figs, 3 refs

**R.B. Bhat, R. Subbiah, and T.S. Sankar
Dynamic Behavior of a Simple Rotor with Dissimilar Hydrodynamic Bearings by Modal Analysis**

J. Vib., Acoust., Stress, Rel. Des., Trans. ASME, 107 (2), pp 267-269 (Apr 1985), 4 figs, 5 refs

P.M. Moretti

Fundamental Frequencies of U Tubes in U-Tube Bundles

J. Pressure Vessel Tech., Trans. ASME, 107 (2), pp 207-209 (May 1985), 3 figs, 13 refs

Y. Frostig and G. Rosenhouse

Modulation-Function Technique in Nonuniform Mechanical Systems

J. Appl. Mech., Trans. ASME, 52 (2), pp 479-483 (June 1985), 1 fig, 18 refs

A.T. Kirkpatrick, M.A. El-Masri, and J.F. Louis

Wave Motion in Liquid Films on Rotating Plates

J. Appl. Mech., Trans. ASME, 52 (2), pp 488-490 (June 1985), 4 figs, 5 refs

K.R. Korde

On Nonlinear Oscillation of Moving String

J. Appl. Mech., Trans. ASME, 52 (2), pp 493-494 (June 1985), 1 fig, 6 refs

S. Deutsch

Frequency-Dependent Damping as an Explanation for the Anomalous Resonance Characteristics of the Auditory Cochlea

Acustica, 57 (1), pp 40-44 (Jan 1985), 7 figs, 10 refs

W.T. Chu

Room Response Measurements in a Reverberation Chamber Containing a Rotating Diffuser

J. Acoust. Soc. Amer., 77 (3), pp 1252-1256 (Mar 1985), 7 figs, 8 refs

M.C. Junger

The Sound Field in a Finite Cylindrical Shell

J. Acoust. Soc. Amer., 77 (4), pp 1610-1612 (Apr 1985), 7 refs

J.F. Allard and B. Sieben

Measurements of Acoustic Impedance in a Free Field with Two Microphones and a Spectrum Analyzer

J. Acoustic Soc. Amer., 77 (4), pp 1617-1618 (Apr 1985), 3 figs, 10 refs

P.A.A. Laura

Comment on "Flutter of Orthotropic Panels in Supersonic Flow Using Affine Transformations"

AIAA J., 22 (4), p 574 (1984), 10 refs

J.A. Brandon

On the Theoretical Justification of Ibrahim's Method

AIAA J., 23 (5), pp 815-816 (May 1985), 5 refs

B.H.K. Lee

Determination of Subcritical Damping in CF-5 Flight Flutter Tests

J. Aircraft, 22 (1), pp 89-91 (Jan 1985), 3 figs, 3 refs

- R.G. Melton
A Composite Model of Aircraft Noise
J. Aircraft, 22 (5), pp 443-444 (May 1985), 2 figs, 1 table, 3 refs
- W.H. Lin
Comments on "Free Transverse Vibrations of Uniform Circular Plates and Membranes with Eccentric Holes"
J. Sound Vib., 92 (4), pp 585-587 (1984), 1 fig, 1 table, 4 refs
- H. Er-Li
No Reciprocal Theorem for Dynamic Displacements
J. Sound Vib., 96 (2), pp 275-276 (Sept 22, 1984)
- K.B. Bota and R.E. Mickens
Approximate Analytic Solutions for Singular Non-Linear Oscillators
J. Sound Vib., 96 (2), pp 277-279 (Sept 22, 1984), 6 refs
- V. Ramamurti and P. Balasubramanian
Application of Potter's Method for Frequency Analysis
J. Sound Vib., 96 (4), pp 513-515 (Oct 22, 1984), 2 tables, 5 refs
- N.W.M. Ko
Flow Behind Coaxial Cylinders Joined by a Tapered Section
J. Sound Vib., 96 (4), pp 516-520 (Oct 22, 1984), 6 figs, 2 refs
- M.D. Wiggins-Grandison and R.E. Mickens
Exact Solutions of Non-Linear Unidirectional Wave Equations
J. Sound Vib., 92 (1), pp 165-166 (Nov 8, 1984), 6 refs
- F.J. Fahy
Rapid Method for the Measurement of Sample Acoustic Impedance in a Standing Wave Tube
J. Sound Vib., 92 (1), pp 168-170 (Nov 8, 1984), 1 fig, 1 ref
- T. Irie, G. Yamada, and Y. Muramoto
Natural Frequencies of In-Plane Vibration of Annular Plates
J. Sound Vib., 92 (1), pp 171-175 (Nov 8, 1984), 5 tables, 10 refs
- P.A.A. Laura, J.C. Utjes, and G.S. Sarmiento
Comments on "Flexural Free Vibrations of Rectangular Plates with Complex Support Conditions"
J. Sound Vib., 92 (1), pp 176-178 (Nov 8, 1984), 2 tables, 9 refs
- P.A.A. Laura, D.R. Avalos, and R. Carnicer
Fundamental Frequency of a Circular Membrane with a Semicircular Perturbation at the Boundary
J. Sound Vib., 92 (1), pp 179-180 (Nov 8, 1984), 1 fig, 1 table, 2 refs
- G.V. Rao and K.K. Raju
On Improving Eigenvalue Accuracies in Finite Element Analysis
J. Sound Vib., 92 (3), pp 523-525 (Dec 8, 1984), 1 table, 3 refs
- S.N. Rao and N. Ganesan
Influence of Unsymmetric Boundary Conditions on Vibrations of Tapered Plates
J. Sound Vib., 92 (3), pp 526-530 (Dec 8, 1984), 3 figs, 3 tables, 4 refs
- J. Szopa
Sensitivity of Stochastic Systems to Initial Conditions
J. Sound Vib., 92 (4), pp 645-649 (Dec 22, 1984), 3 figs, 2 tables, 5 refs
- P. Verniere de Irassar, G. Ficcadenti, and L.C. Nava
A Note on Transverse Vibrations of a Non-Homogeneous Cardioid Membrane
J. Sound Vib., 92 (4), pp 650-652 (Dec 22, 1984), 2 figs, 1 table, 3 refs
- E. Uchino and M. Ohta
General State Estimation Algorithm for Quantized Noisy Systems by Statistical Equivalent Linearization Method, with Special Reference to Room Acoustics
J. Sound Vib., 92 (4), pp 653-657 (Dec 22, 1984), 4 figs, 4 refs
- T. Das and R. Sircar
Free Flexural Vibration of an Isosceles Right Angled Triangular Plate Resting on a Non-Linear Elastic Foundation, at Large Amplitude
J. Sound Vib., 92 (4), pp 658-661 (Dec 22, 1984), 3 figs, 3 refs

J.W. Nicholson and L.A. Bergman
On the Efficacy of the Modal Series Representation for the Green Functions of Vibrating Continuous Structures
J. Sound Vib., 28 (2), pp 299-304 (Jan 22, 1985), 1 table, 11 refs

A. Sestieri
Discretization Procedures for the Green Formulation of Structural-Acoustic Problems
J. Sound Vib., 28 (2), pp 305-308 (Jan 22, 1985), 1 fig, 5 refs

R.S. Langley
On the Conditional Distribution of Velocity for a Stochastic Process
J. Sound Vib., 28 (2), pp 309-311 (Jan 22, 1985), 1 ref

Y. Hirata
The Sound Pressure Response When the Play-Back Method is Used in a Reverberant Chamber
J. Sound Vib., 28 (4), pp 589-591 (Feb 22, 1985), 1 fig, 2 refs

H.M.E. Miedema
Annoyance Caused by Two Noise Sources
J. Sound Vib., 28 (4), pp 592-595 (Feb 22, 1985), 1 fig, 3 refs

P.J.T. Filippi and J. Piraux
Noise Sources Modeling and Identification
J. Sound Vib., 28 (4), pp 596-600 (Feb 22, 1985), 6 tables

A. Bianchi, D.R. Avalos, and P.A.A. Laura
A Note on Transverse Vibrations of Annular, Circular Plates of Rectangular Orthotropy
J. Sound Vib., 29 (1), pp 140-143 (Mar 8, 1985) 5 tables, 3 refs

V.H. Cortinez and P.A.A. Laura
Vibrations and Buckling of a Non-Uniform Beam Elastically Restrained Against Rotation at One End and with Concentrated Mass at the Other
J. Sound Vib., 29 (1), pp 144-148 (Mar 8, 1985) 2 figs, 4 tables, 6 refs

J.-C. Nissen, K. Popp, and B. Schmalhorst
Optimization of a Non-Linear Dynamic Vibration Absorber
J. Sound Vib., 29 (1), pp 149-154 (Mar 8, 1985) 6 figs, 1 table, 5 refs

I. Sahin and A. Aybar
A Survey on Semisubmersible Wind Loads
Ocean Engrg., 12 (3), pp 253-261 (1985) 1 table, 18 refs

J.S. Tomar and R. Jain
Thermal Effect on Frequencies of Coupled Vibrations of Pretwisted Rotating Beams
AIAA J., 23 (8), pp 1293-1296 (Aug 1985) 2 figs, 1 table, 11 refs

FEATURE ARTICLES

	ISSUE	PAGES
Watkinson, P.S. Sound Intensity Measurement	1	3-13
De, Sasadhar The Effects of Seismic Waves	2	3-32
Munjal, M.L. Recent Advances in the Analysis of Exhaust Mufflers	3	3-16
Reddy, J.N. A Review of the Literature on Finite-Element Modeling of Laminated Composite Plates	4	3-8
Abdulhadi, M.I. Stiffness and Damping Coefficients of Rubber	5	3-9
Rades, M. Frequency Domain Experimental Modal Analysis Techniques	6	3-15
Kelly, J.M. Aseismic Base Isolation	7	3-14
deSilva, C.W. Computer-Automated Failure Prediction in Mechanical Systems under Dynamic Loading	8	3-12
Adeli, H. and Sierakowski, R.L. Impactor Interaction with Concrete Structures -- Local Effects	9	3-16
Jones, D.I.G. High Temperature Damping of Dynamic Systems	10	3-5
Bert, C.W. Research on Dynamic Behavior of Composite and Sandwich Plates -- IV	11	3-15
Laura, P.A.A. Acoustic Emissions from Wire and Synthetic Ropes	12	3-5

LITERATURE REVIEWS

	ISSUE	PAGES
Abrate, S. Continuum Modeling of Latticed Structures	1	15-21
Jones, S. Recent Progress in the Dynamic Plastic Behavior of Structures. Part IV	2	35-47
Lalanne, M. Vibration Problems in Jet Engines	3	19-24
Etsion, I. Mechanical Face Seal Dynamics Update	4	11-15
D'Angelo, III, C., Alvarado, N.T., Wang, K.W., and Mote, Jr., C.D. Current Research on Circular Saw and Band Saw Vibration and Stability	5	11-23
Gopalan, T.V. and Nagabhushana, G.R. Flexural Rigidity of Stranded Cables	6	17-20
Johns, D.J. Wind-Excited Behaviour of Structures IV	7	17-34
Vaicaitis, R. Noise Transmission into Propeller Aircraft	8	15-20
Sathyamoorthy, M. Recent Research in Nonlinear Analysis of Beams	9	19-27
Reinhorn, A.M. and Manolis, G.D. Current State of Knowledge on Structural Control	10	7-16
Beards, C.F. Damping in Structural Joints	11	17-20
Long, D.F. and Arndt, R.E.A. Recent Research on Turbulent Flow Noise Mechanisms	12	7-15

BOOK REVIEWS

Ash, E.A. and Hills, C.R., Eds., Acoustical Imaging, Volume 12, Plenum Publishing Corp., New York, 1982; Reviewed by V.R. Miller, SVD, 17 (9), pp 29-30 (Sept 1985).

Belytschko, T. and Hughes, T., Eds., Computational Methods for Transient Analysis, Elsevier Science Publishers, New York, 1983; Reviewed by A.K. Noor, SVD, 17 (6), pp 21-23 (June 1985).

Berkhout, A.J., Seismic Migration. Imaging of Acoustic Energy by Wave Field Extrapolation. A Theoretical Aspect, Elsevier Scientific Publ., Amsterdam and New York, 1982; Reviewed by S.K. Datta, SVD, 17 (2), p 49 (Feb 1985).

Beranek, L.L., Ed., Noise Reduction, Robert E. Krieger Pub. Co., Inc., Melbourne, FL, 1980; Reviewed by V.R. Miller, SVD, 17 (7), p 35 (July 1985).

Bolotin, V.V., Random Vibrations of Elastic Systems, Martinus Nijhoff Publishers, The Hague, The Netherlands, 1984; Reviewed by R.A. Ibrahim, SVD, 17 (7), pp 37-39 (July 1985).

Borissov, M., Ed., Optical and Acoustic Waves in Solids — Modern Topics, World Scientific Pub. Co., 1983; Reviewed by V.R. Miller, SVD, 17 (7), pp 36-37 (July 1985).

Burdic, W.S., Underwater Acoustic System Analysis, Prentice-Hall, Inc., Englewood Cliffs, NJ, 1984; Reviewed by V.R. Miller, SVD, 17 (9), p 30 (Sept 1985).

Chajes, A., Structural Analysis, Prentice Hall, Inc., Englewood Cliffs, NJ, 1983; Reviewed by H. Saunders, SVD, 17 (2), pp 51-52 (Feb 1985).

Chen, F.Y., Mechanics and Design of Cam Mechanisms, Pergamon Press, Inc., Elmsford, NY, 1982; Reviewed by C. Reinholtz, SVD, 17 (12), pp 18-19 (Dec 1985).

Chu, D.F.H., Ed., Modal Testing and Model Refinement, ASME, New York, 1983; Reviewed by H. Saunders, SVD, 17 (4), pp 18-19 (Apr 1985).

Collins, J.A., Failure of Materials in Mechanical Design, John Wiley and Sons, New York, 1981; Reviewed by S.E. Benzley, SVD, 17 (4), p 17 (Apr 1985).

Das, B.M., Fundamentals of Soil Dynamics, Elsevier Scientific Publ., Amsterdam and New York, 1983; Reviewed by S.K. Saxena, SVD, 17 (2), pp 48-49 (Feb 1985).

deSilva, C.W., Dynamic Testing and Seismic Qualification Practice, Lexington Books, D.C. Heath & Co., Lexington, MA; Reviewed by D.D. Kana, SVD, 17 (5), pp 24-25 (May 1985).

Doebelin, E.O., Measurement Systems — Application and Design, McGraw-Hill Book Co., New York, 3rd Edition, 1983; Reviewed by H. Saunders, SVD, 17 (6), pp 25-26 (June 1985).

Fielding, L.E., Handheld Calculator Programs for Rotating Equipment Design, McGraw-Hill Book Co., New York, NY, 1983; Reviewed by H. Saunders, SVD, 17 (11), pp 23-25 (Nov 1985).

Franke, M.E. and Drzewiecki, T.M., Eds., Fluid Transmission Line Dynamics, ASME, New York, 1983; Reviewed by M.Z. Lee, SVD, 17 (2), p 48 (Feb 1985).

Goldstein, H., Classical Mechanics, Addison-Wesley, Reading, MA, 1980; Reviewed by L.Y. Bahar, SVD, 17 (5), pp 26-27 (May 1985).

Hamming, R.W., Digital Filters, Prentice-Hall, Inc., Englewood Cliffs, NJ; Reviewed by H. Saunders, SVD, 17 (9), pp 28-29 (Sept 1985).

Jayatilaka, A. de S., Fracture of Engineering Brittle Materials, Applied Science Publishers, Ltd., London, 1979; Reviewed by K.E. Hofer, SVD, 17 (1), p 24 (Jan 1985).

Kane, T.R., Likins, P.W., and Levinson, D., Spacecraft Dynamics, McGraw-Hill, New York, 1983; Reviewed by L.Y. Bahar, SVD, 17 (5), p 25 (May 1985).

Kinsler, L.E., Frey, A.R., Coppens, A.B., and Sanders, J.V., Fundamentals of Acoustics, John Wiley and Sons, New York, NY, 1982; Reviewed by V.R. Miller, SVD, 17 (11), pp 21-22 (Nov 1985).

Kolousek, V., Pirner, M., Fischer, O., and Naprstek, J., Wind Effects on Civil Engineering Structures, Elsevier Scientific Publ., Amsterdam and New York, 1984; Reviewed by S.S. Chen, SVD, 17 (1), p 22 (Jan 1985).

Lalanne, M., Berthier, P., and Der Hagopian, J., Mechanical Vibrations for Engineers, John Wiley and Sons, New York, 1983; Reviewed by H.C. Pusey, SVD, 17 (2), pp 49-51 (Feb 1985).

Macinante, J.A., Seismic Mountings for Vibration Isolation, John Wiley and Sons, New York, 1984; Reviewed by H.C. Pusey, SVD, 17 (1), pp 22-24 (Jan 1985).

Matthews, J.R., Ed., Acoustic Emission, Gordon and Breach Science Publishers, New York, 1983; Reviewed by R.J. Peppin, SVD, 17 (5), pp 27-28 (May 1985).

Milne, P.H., Underwater Acoustic Positioning Systems, Gulf Publishing Co., Houston, TX, 1983; Reviewed by V.R. Miller, SVD, 17 (11), p 21 (Nov 1985).

Moody, F.J., Ed., Two Phase Flow and Waterhammer Loads in Vessels, Piping and Structural Systems, ASME, New York, NY, 1984; Reviewed by K.E. Hofer, SVD, 17 (12), p 16 (Dec 1985).

Noor, A. and Pilkey, W., Eds., State-of-the-Art Surveys on Finite Element Technology, ASME, New York, 1983; Reviewed by M.M. Hurwitz, SVD, 17 (4), p 16 (Apr 1985).

Paz, M., Structural Dynamics Theory and Computation, Van Nostrand Reinhold Co., New York, NY, 1985; Reviewed by R.A. Ibrahim, SVD, 17 (10), pp 17-18 (Oct 1985).

Perrone, N., Pilkey, W., and Pilkey, B., Eds., Structural Mechanics Software Series V, University Press of Virginia, Charlottesville, VA, 1985; Reviewed by M.M. Hurwitz, SVD, 17 (10), pp 20-21 (Oct 1985).

Ragulskis, K., Varanaukas, P., Lelinas, V., Bentkus, R., and Andruskevicius, A., The Dynamics of Precise Tape Drives, Leidykla Mokslas, Vilnius, USSR, 1984 (In Russian); Reviewed by A. Longinow, SVD, 17 (12), pp 17-18 (Dec 1985).

Rasband, S.N., Dynamics, John Wiley and Sons, New York, NY, 1983; Reviewed by H. Saunders, SVD, 17 (11), pp 22-23 (Nov 1985).

Rosenberg, R.C. and Karnopp, D.C., Introduction to Physical System Dynamics, McGraw-Hill Book Co., New York, NY, 1983; Reviewed by A. Frank D'Souza, SVD, 1Z (8), p 21 (Aug 1985).

Ross, C.T.F., Finite Element Programs for Axisymmetric Problems in Engineering, Halsted Press, Div. of John Wiley and Sons, New York, 1984; Reviewed by J.T. Oden, SVD, 1Z (3), p 25 (March 1985).

Rosberg, K., A First Course in Analytical Dynamics, John Wiley & Sons, New York, NY, 1983; Reviewed by R.A. Ibrahim, SVD, 1Z (10), pp 19-20 (Oct 1985).

Sabnis, G.M., Harris, H.G., White, R.N., and Mirza, M.S., Structural Modeling and Experimental Techniques, Prentice-Hall, Inc., Englewood Cliffs, NJ, 1983; Reviewed by V.R. Miller, SVD, 1Z (9), pp 30-31 (Sept 1985).

Sevik, M.M., Ed., Turbulence-Induced Vibrations and Noise of Structures, ASME, New York, NY, 1983; Reviewed by V.R. Miller, SVD, 1Z (8), pp 22-23 (Aug 1985).

Shah, V.N. and Ma, D.C., Eds., Seismic Effects in PVP Components, ASME, New York, 1984; Reviewed by K.E. Hofer, SVD, 1Z (7), pp 35-36 (July 1985).

Shih, C.F. and Gudas, J.P., Eds., "Elastic Plastic Fracture." Second Symposium Volume I: Inelastic Crack Analysis, ASTM, Philadelphia, PA, 1983; Reviewed by K.E. Hofer, SVD, 1Z (3), pp 25-27 (March 1985).

Shih, C.F. and Gudas, J.P., Eds., "Elastic Plastic Fracture." Second Symposium Volume II: Fracture Resistance Curves and Engineering Applications, ASTM, Philadelphia, PA, 1983; Reviewed by K.E. Hofer, SVD, 1Z (3), pp 27-30 (March 1985).

Society of Automotive Engineers, Aircraft Noise Handbook, SAE, Warrendale, PA, 1984; Reviewed by V.R. Miller, SVD, 1Z (8), pp 23-24 (Aug 1985).

Stanomir, D., Electroacoustic Systems. Field Radiation and Transduction, Editura Tehnica, Bucharest, Roumania, 1984; Reviewed by M. Rades, SVD, 1Z (8), pp 21-22 (Aug 1985).

Stijgeren, E.V., Ed., Piping Engineering Today: Innovative Solutions through Analysis, Testing, and Experience, ASME, New York, NY, 1984; Reviewed by K.E. Hofer, SVD, 1Z (12), pp 16-17 (Dec 1985).

Tustin, W. and Mercado, R., Random Vibration in Perspective, Tustin Institute of Technology, Santa Barbara, CA, 1984; Reviewed by H. Saunders, SVD, 1Z (6), pp 23-25 (June 1985).

Urick, R.J., Principles of Underwater Sound, McGraw-Hill Book Co., New York, NY, 1983; Reviewed by V.R. Miller, SVD, 1Z (10), p 21 (Oct 1985).

Weaver, H.J., Applications of Discrete and Continuous Fourier Analysis, John Wiley and Sons, New York, 1983; Reviewed by H. Saunders, SVD, 1Z (4), pp 17-18 (Apr 1985).

Zinkham, R.E., Ed., Fracture Toughness of Weldments, ASME, New York, 1984; Reviewed by K.E. Hofer, SVD, 1Z (6), p 21 (June 1985).

LIST OF REVIEWERS

Abrate, S.
Adams, Jr., M.L.
Agrawal, B.N.
Allaire, P.E.
Al-Mousawi, M.
Arndt, R.E.A.
Bahar, L.Y.
Baker, W.E.
Barrett, L.
Beards, C.F.
Beltzer, A.I.
Bernard, J.E.
Bert, C.W.
Blanks, H.S.
Broek, D.
Bucci, R.
Camras, M.
Caseiro, C.
Chang, C.H.
Chen, S.-s.
De, S.
deSilva, C.W.
DiMaggio, F.L.
Dökmeçi, M.C.
Dubey, R.N.
Etsion, I.
Etter, P.C.
Ewins, D.J.
Flack, R.D.
France, D.
GangaRao, H.V.S.
Genin, J.
Gibson, R.F.
Ginsberg, J.H.
Gopalakrishnan, S.

Goranson, U.
Greif, R.
Griffin, M.J.
Gupta, A.D.
Halford, G.
Hertzberg, R.
Hofer, K.
Holmes, R.
Holzer, S.
Hundal, M.S.
Huseyin, K.
Ibrahim, R.A.
Ignaczak, J.
Iwatsubo, T.
Jaske, C.
Johns, D.J.
Jones, D.I.G.
Jones, N.
Kelly, J.M.
Kiger, S.A.
Krajcinovic, D.
Lafien, J.H.
Lalanne, M.
Landgraf, R.
Leis, B.N.
Leissa, A.
Longinow, A.
Malanoski, S.
Manolis, G.D.
Massoud, M.
Mazumdar, J.
Metwalli, S.M.
Miller, V.
Milsted, M.G.
Mindlin, H.

Mote, C.D.
Mulcahy, T.M.
Munjal, M.L.
Nakra, B.C.
Nicholson, D.
Peppin, R.J.
Platzner, M.F.
Plunkett, R.
Poppewell, N.
Rades, M.
Ramamurti, V.
Rao, D.K.
Rao, J.S.
Rao, S.S.
Reddy, J.N.
Reifsnider, K.
Roberts, J.B.
Romilly, N.
Rungta, R.
Sankar, T.S.
Sathyamoorthy, M.
Saunders, H.
Shapton, C.W.
Shetty, D.
Sierakowski, R.L.
Soltis, L.
Spanos, P.D.
Stadelbauer, D.
Ting, E.C.
To, C.W.S.
Tondl, A.
Triantafyllou, M.
Vaiçaitis, R.
Watkinson, P.
Witlin, G.

AUTHOR INDEX

- A -

Abbas, B.A.H.....	2264	Akiyama, A.....	2242
Abdel-Ghaffar, A.M.....	467	Akiyama, Y.....	2069
Abdulhadi, M.I.....	1955	Akkari, M.M.....	570
Abdulrahman, S.H.....	700	Akkas, N.....	1939
Abdul-Salam Alani, H.R.....	1737	Akkok, M.....	543
Abd-El-Rahman, M.A.M.....	1876	Aknine, A.....	1365, 1652
Abd-Rabbo, A.....	2311	Aksu, G.....	581
Abe, T.....	51, 1556	Aktan, A.E.....	97, 481
.....	1811	Akylas, T.R.....	385
Abel, I.....	1839	Alam, M.....	1498
Abhyankar, N.S.....	1157	Alam, N.....	2290
Abramowicz, W.....	1130, 1131	Alberg, H.....	206
Abrate, S.....	796	Albers, W.F.....	1925
Achenbach, J.D.....	620, 997	Albrecht, G.....	397
.....	1674, 2145	Alderson, M.A.H.G.....	1804
Acosta, A.J.....	1071, 1073	Aleamar, J.D.....	2120
Adali, S.....	1168, 1898	Alemdaroglu, H.N.....	1476
Adams, M.L.....	209, 712	Alforque, R.....	1918
Adams, Jr., M.L.....	655	Ali, R.....	854
Adams, R.D.....	793, 2373	Ali, S.A.....	560
.....	2391, 2525, 2544	Aljaweini, S.M.....	721
Adams, R.G.....	1275	Allaire, P.E.....	193, 1072
Adams, Jr., W.M.....	1550	Allard, J.F.....	1365, 1652
Adamson, Jr., T.C.....	815	Allemang, R.J.....	633, 1437
Adcock, J.....	1434	Allen, D.H.....	2491
Aggarwal, J.K.....	851	Allen, R.H.....	469
Aggarwal, M.L.....	327	Alvarado, N.T.....	2203
Agrawal, B.N.....	2476, 2488	Alwar, R.S.....	541
Aguliar, J.....	1289	Alwis, W.A.M.....	2280
Aguirre R., J.....	2162	Alzheimer, J.M.....	2300
Aguirre R., J.E.....	2157	Al-Mousawi, M.M.....	70
Ahlbeck, D.R.....	2037	Al-Sheikh, A.M.S.....	2457
Ahmad, M.F.....	738	Amada, S.....	584
Ahmadi, G.....	486	Amdahl, J.....	2404
Ahmadian, M.....	1254, 2188	Amin, A.M.M.....	2394
Ahmed, K.M.....	675	Amirouche, M.L.....	1664, 2494
Ahn, T.Y.....	2025, 2026	Amos, R.J.....	2046
Ahrens, H.....	1777	Andersen, G.C.....	2498
Ahuja, K.K.....	93	Anderson, C.A.....	575
Ahuja, S.....	1025	Anderson, D.L.....	732
Aida, T.....	559	Anderson, M.J.....	945, 946
Aihara, Y.....	2576	.....	2301
Aillaud, P.....	107	Anderson, M.S.....	2499
Aindow, A.M.....	1245	Anderson, W.J.....	191
Aita, S.....	1102, 1292	Ando, J.....	2584
Aizawa, T.....	416, 1487	Ando, Y.....	2469
Akgun, M.....	1644	Andrews, R.P.....	1276
Akimoto, T.....	592	Andronikou, A.M.....	187
		Angel, Y.C.....	1674
		Angell, J.C.....	862

Anile, A.M. 622, 624
 Annis, J.R. 1422
 Ansari, J. 1623
 Antolovich, S.D. 137
 Anton, E. 204, 225
 Aoki, M. 702
 Aoki, S. 96
 Aoshima, N. 396
 Apetaur, M. 2050, 2051
 Appa, K. 2464
 Appel, H. 1299
 Arai, H. 29
 Arai, J. 283
 Arai, N. 2082
 Arakawa, N. 1414, 1712
 Araki, K. 546
 Arambages, A. 2512
 Arczewski, K. 1984
 Ardayfio, D.D. 861
 Arii, R. 228
 Ariyoshi, S. 711
 Arizmendi, L. 1405
 Ari-Gur, J. 732
 Arora, J.S. 190, 1489
 Arrowsmith, D.K. 643
 Arroyo, A.G. 837
 Artiles, A. 1575
 Arya, A.S. 1788
 Asada, Y. 1403
 Asami, T. 1129, 2131
 Asfar, K.R. 1269
 Asfura, A. 763
 Asfura Facuse, A. 2344
 Ashida, M. 791
 Ashley, C.E. 766
 Ashley, H. 520
 Askar, A. 1976, 1977
 Asnani, N.T. 2290
 Astaneh-Asl, A. 65
 Astley, R.J. 656
 Atadan, A.S. 852, 1253
 2605
 Atluri, S.N. 2481
 Atsumi, M. 981
 Auckland, D.W. 1057
 August, R. 903
 Austin, C.D. 2458
 Austin, M.D. 2449
 Autrusson, B. 27
 Au-Yang, M.K. 1457, 2226
 Avanesian, V. 879
 Avdelas, A.V. 2360
 Avitabile, P. 149
 Avva, V.S. 618
 Axelrad, D.R. 1199
 Axelsson, H. 333
 Axisa, F. 23, 2326, 2329

Axton, G.E. 2158
 Ayabe, T. 2523

- B -

Babbivale, V.K. 1331
 Babu, B.J.C. 2557
 Bachschmid, N. 220
 Bachtell, E.E. 2500
 Bacteman, O. 498
 Badawy, E.M. 1499
 Badley, M. 1656
 Bagga, K.S. 2431
 Bagley, R.L. 2134
 Bahar, L.Y. 1250
 Bailey, P.A. 1092
 Bailey, R.T. 2308
 Bainum, P. 1310
 Bajaj, A.K. 2187
 Bajer, C.I. 731
 Baker, J.M. 2418
 Baker, K.A. 1326
 Baker, M. 2489
 Baker, R.N. 505
 Baker, W.E. 356, 1375
 Balas, G.J. 2501
 Balasubramania. 542
 Balda, M. 5, 413
 Baldwin, E. 1556
 Baldwin, R.M. 67
 Balendra, T. 472, 495
 568, 2029
 Bamberger, A. 1384
 Bampton, M.C.C. 2300
 Banaszak, D. 1413
 Bandow, H.E. 1579, 1580
 Banerjee, B. 1912
 Banerjee, J.R. 519, 2262
 Banerjee, P.K. 1285
 Banerjee, S. 106
 Banwatt, A.S. 1531
 Bapat, C.N. 2138
 Barasch, M. 1483
 Barauskas, R. 1184
 Barger, J.E. 927
 Barghouthi, A.F. 235
 Barker, D.B. 1223
 Barkley, R.C. 350, 352
 Barnard, R.D. 1181
 Barnes, C.R. 1407
 Barnett, J.O. 1569
 Barr, A.D.S. 562, 701
 1962
 Barrett, L.E. 193
 Barson, C.W. 2043
 Barta, D.A. 42, 945, 946, 2301

Bartels, M.....	1263	Berger, H.L.....	212
Barton, F.W.....	193	Berges, H.P.....	1063
Baruch, M.....	178	Bergman, L.A.....	2408, 2580
Baruh, H.....	2608	Bergmann, M.....	2071
Bar-on, E.....	759	Berkhout, A.J.....	1190
Basel, R.....	523, 525	Berlinsky, Y.....	759
Basol, M.....	880	Berman, A.....	853
Basu, R.I.....	1099	Berman, D.....	2116
Bathe, K.-J.....	2361	Berman, J.H.....	2463
Batina, J.T.....	1946, 2472	Bernard, J.E.....	1814
.....	2577	Bernardo, J.M.....	1405
Batson, G.B.....	778	Berndt, C.C.....	1680
Batterham, A.J.....	1766	Bernhard, R.....	1307
Baudrenghien, P.A.....	1005	Bernhard, R.J.....	2603
Bauer, H.....	1829	Bernitsas, M.M.....	191
Bauer, H.F.....	122, 692	Berry, H.M.....	2577
.....	782	Berry, L.D.....	2167
Baum, A.S.....	1417, 1418	Berryman, J.G.....	2189
Baumann, H.....	831	Bert, C.W.....	933, 1598
Bavonese, J.....	2506	.....	2539
Baxter, S.M.....	1351	Bert, D.R.....	2539
Baxter, W.J.....	1231	Bertaut, C.....	1102
Bayati, A.....	833	Bertero, V.V.....	97, 481
Beards, C.F.....	1607	Berthold, J.....	455
Bearman, P.W.....	2269	Bertke, R.S.....	1574
Beattie, K.R.....	1851, 1852	Bertram, A.....	819
Beatty, M.F.....	1589	Beskos, D.E.....	1618
Beatty, R.F.....	1973	Best, G.....	1086
Beauchamp, P.P.....	1318	Bettadapur, S.S.....	2500
Beaulieu, G.....	2255	Betts, W.S.....	838
Bech, A.....	1789, 1809	Betzina, M.D.....	2005
Becker, O.....	2322	Beyers, M.E.....	1475
Bedford, A.....	985, 2352	Bezler, J.....	259
Beer mann, H.J.....	2527	Bezler, P.....	1291, 1918
Beeuwkes, Jr., R.....	617	Bhadra, P.....	308
Beigelman, Z.....	540	Bhagat, R.B.....	2143
Beissner, K.....	768, 1928	Bhaskaran, T.A.....	126
Beissner, R.E.....	1642	Bhat, G.I.....	1066
Bekey, G.A.....	187	Bhat, M.S.....	2396
Beliveau, J.-G.....	1735, 2581	Bhat, R.....	1280
Bell, R.....	2105	Bhat, R.B.....	1015, 1612
Belvin, W.K.....	569	Bhatia, K.G.....	2057, 2058
Belyaev, A.K.....	848	Bhatia, R.S.....	1902
Belytschko, T.....	175, 1035	Bhattacharyya, R.....	1503
.....	2186	Bhatti, M.A.....	1615
Benaroya, H.....	2574	Bhatti, M.H.....	1517, 1784
Benda, B.J.....	326	Bhujanga Rao, V.....	1651
Benedetti, D.....	667	Bieber, E.....	2031
Benedetto, G.....	330, 1935	Bielawa, R.L.....	1760
Bennett, M.D.....	1824	Bieniek, M.P.....	2586
Bennighof, J.K.....	2611	Biezad, D.J.....	1542
Bennouna, M.M.....	1162, 1163	Bigret, R.....	1278
Bentley, W.M.....	2179	Billing, J.R.....	1282
Bently, D.E.....	1137, 1267	Bindal, V.N.....	835
Benzoni, G.M.....	667	Blachut, J.....	1166
Berczynski, S.....	461	Black, W.E.....	838
Bergamaschi, S.....	727	Blackwelder, R.F.....	2234

Blair, M.A..... 1471, 2150
 Blakely, K..... 1750, 2001
 Bland, S.R..... 1300
 Bland, T.L..... 1851, 1852
 Blech, J.J..... 120
 Blevins, J.G..... 2478
 Blevins, R.D..... 2304, 2324
 Block, P.J.W..... 403, 952
 Blomquist, D.S..... 2173
 Blouin, S.E..... 2219
 Bloy, A.W..... 2348
 Boddington, P.H.B..... 549
 Bodlund, K..... 1677
 Boelcs, A..... 222
 Bofilios, D.A..... 1544, 2561
 Bogacz, R..... 681
 Bogdanoff, J.L..... 132, 2606
 Bogy, D.B..... 1725
 Bohao, S..... 1772
 Bohlen, S..... 1988
 Boissonnade, A.C..... 969
 Bojadziev, G.N..... 850
 Bolding, R.M..... 358
 Bolleter, U..... 2307
 Bolton, J.S..... 399
 Bolton, M.D..... 2345
 Bonakdarzadeh, S..... 437
 Bonciani, L..... 1064
 Bonissone, P.P..... 2161
 Bonnecase, D..... 1435
 Book, W.J..... 38
 Booker, J.F..... 278
 Boone, M.M..... 1190
 Borggrafe, J..... 455
 Borri, M..... 2191
 Borthwick, W.K.D..... 857
 Bosnik, J.R..... 1146
 Bostian, D.A..... 755, 1907
 Bostic, S.W..... 2595
 Bouchard, D..... 1961
 Bouchard, G..... 1725
 Bouchon, M..... 1193
 Bourgeois, J.M..... 1481
 Bourne, F.R..... 697
 Bouten, H..... 1897
 Bouwkamp, J.G..... 1785
 Bowles, P.J..... 1599
 Bowman, L.M..... 1260
 Bowman, M.D..... 548
 Boxwell, D.A..... 1846
 Boymel, A..... 911
 Brabant, F..... 24
 Bradford, E.W..... 2391
 Bragdon, C.R..... 1118
 Branagan, L.A..... 1072
 Branch, H.D..... 704, 708
 Brandeis, J.P..... 2017

Brandl, F.K..... 2016
 Brandon, J.A..... 989
 Bras, J.C.M..... 1136
 Brazier-Smith, P.R..... 966
 Breitling, U..... 1866
 Brennan, M..... 2456
 Brennen, B..... 378
 Brennen, C.E..... 1071, 1073
 Brindley, J..... 57, 58
 Brinkman, B.A..... 1719
 Britcher, C.P..... 1971
 Brock, L.M..... 1671, 2142
 2355
 Brockman, R.A..... 34
 Brod, K..... 604
 Brodzinski, R..... 1321
 Brodzinski, R.P..... 1445
 Brooks, T.F..... 1370
 Brosh, A..... 2127
 Brown, A.L..... 1558
 Brown, A.P..... 1678
 Brown, D.L..... 1437, 1694
 Brown, G.V..... 406
 Brown, J.E..... 1568
 Brown, J.M.B..... 1488
 Brown, P.R..... 2049
 Brown, R.D..... 294, 1150
 Brown, R.N..... 904
 Brown, T.A..... 1705
 Brown, W.H..... 93, 2571
 Bruckstein, A.M..... 1981
 Brudar, B..... 840
 Brumen, C..... 2235
 Bruneau, A.M..... 2123
 Bruneau, M..... 2123
 Brunelle, E.J..... 1336, 1925
 Bruns, H..... 1817
 Bryanston-Cross, P..... 2514
 Bublitz, P..... 1383
 Bucker, H.P..... 2353
 Buckholz, R.H..... 900
 Buffinton, K..... 2398
 Bui-Quoc, T..... 141
 Bujanovic, B..... 427
 Buland, P..... 107
 Bull, M.K..... 84
 Bulman, D.N..... 1865
 Bulmash, G..... 344
 Bundas, D.J..... 657
 Burd, A.N..... 693
 Burd, G.S..... 2377
 Burdess, J.S..... 1560
 Burdick, R.B..... 1428
 Burger, W..... 831
 Burroughs, C.B..... 755, 1907
 Burrows, C.R..... 280, 1214
 Burrows, G.W..... 1650

Burton, T.D..... 1037, 1982
 Busby, H..... 823
 Busturia, J.M..... 1462
 Byrne, K.P..... 1372

- C -

Cabannes, H..... 1588
 Cai, Qigong..... 2079
 Calarese, W..... 1309
 Caldersmith, G.W..... 921
 Calico, R.A..... 250, 250
 Calladine, C.R..... 1861
 Calleson, R.E..... 2498
 Cameron, D.W..... 1667
 Campbell, G.E..... 369
 Campbell, W.R..... 2169
 Campos, L.M.B.C..... 947
 Can, M..... 1976, 1977
 Cao, Zhiyuan..... 2220
 Caplot, M..... 1848
 Caradonna, F.X..... 2248
 Carasso, A.S..... 2153
 Carbone, A..... 1174
 Cardona, A..... 668, 856
 2190
 Carey, J.H..... 2177
 Carey, J.J..... 117
 Cargile, J.D..... 435
 Carley, T.G..... 296
 Carne, T.G..... 630, 1164
 1284
 Carpinteri, Al..... 69
 Carpinteri, An..... 69
 Carrascosa, L.I..... 1462
 Carta, F.O..... 2233
 Caruso, H..... 2617
 Cassenti, B.N..... 990
 Castagna, J..... 1687
 Castellani, A..... 1723
 Catlin, J.B..... 2180
 Caughey, T.K..... 828, 1073
 Cave, L.E..... 217
 Cazier, F.W..... 1843
 Cazzoli, E.G..... 440
 Ce, Zhang..... 1325, 1585
 Ceballos, D.C..... 1554
 Cecen, H..... 484, 485
 Cegielski, E..... 1342
 Censor, D..... 811
 Cerami, A..... 878
 Cerwin, S.A..... 2382
 Chakrabarty, S.K..... 934
 Chakravarthy, S.R..... 1113
 Chalco, T.J..... 234
 Chamis, C.C..... 264, 1050

Champion, D.F..... 527
 Chan, Eng Soon..... 568
 Chan, H.F..... 1558
 Chan, R..... 1558
 Chan, S.P..... 1908, 2296
 Chan, T.F..... 417
 Chandler-Wilde, S..... 2347
 Chandra, B..... 1788
 Chandra, S..... 982
 Chandrashekara, K..... 1911
 Chang, A.T..... 698
 Chang, Cheng-Song..... 2075
 Chang, Chia-Ou..... 2137
 Chang, C..... 1927
 Chang, Hsiu Guo..... 2366
 Chang, H.S..... 53
 Chang, I.-J..... 1921
 Chang, J.B..... 377
 Chang, J.-H..... 1711
 Chang, K.T..... 240
 Chang, P.C..... 572
 Chang, Rong-Yeu..... 177, 1998
 Chang, Shyang..... 2474
 Chang, Si..... 1430
 Chang, Y.S..... 394
 Chang, Y.W..... 192, 882
 1293
 Chapman, D.A..... 553
 Charles, C..... 1611
 Chattopadhyay, A..... 1160, 2534
 Chaturvedi, S.K..... 2135
 Chaudhury, G.K..... 1294
 Chen, C.K..... 1510
 Chen, Huei-Tsyr Jeremy..... 1525
 Chen, Huo-Wang..... 342
 Chen, H. Ming..... 2600
 Chen, H. Q..... 240
 Chen, Jay-Chung..... 183, 825
 1595
 Chen, Jeng-Shyong..... 1426
 Chen, Jingyu..... 1440
 Chen, Jinn-Kuen..... 1661
 Chen, J.C..... 1105
 Chen, K.C..... 549
 Chen, Lien-Wen..... 80, 311
 744, 1614, 1619
 Chen, Ping-Chih..... 1900
 Chen, P..... 593, 594
 595
 Chen, P.S..... 991
 Chen, Qiangen..... 1716
 Chen, R.Z..... 1535
 Chen, Shyi-Yaung..... 2609
 Chen, Su-Huan..... 1717, 1733
 1736
 Chen, S..... 1768
 Chen, S.C..... 1376

Chen, S.S.....	116, 328	Chu, Yiqing.....	2065
.....	983, 1347, 1635, 2314	Chuang, S.L.....	92
Chen, T.K.....	2473	Chuang, T.Y.....	324, 326
Chen, Wei-zhang.....	660	Chucheeepsakul, S.....	1810
Chen, Wen-Hwa.....	2093	Chugh, A.K.....	2036
Chen, W.C.....	1587	Chun, R.C.....	324, 1105
Chen, Yaodong.....	1730	Chung, H.....	983
Chen, Y.C.....	72	Chung, I.S.....	2423
Chen, Y.N.....	2307, 2336	Chung, Yung-Tseng.....	1471, 2589
Chen, Y.S.....	1578	Clark, G.....	1700
Chen, Zhongyi.....	1688	Clark, G.A.....	1552
Cheng, Yaodong.....	1432, 1716	Clark, M.....	1411
Chenoweth, J.M.....	2318, 2319	Clarkson, B.L.....	59, 79
Cheung, J.T.....	2000	Clay, C.S.....	1368
Cheung, Y.K.....	154, 924	Cleghorn, W.L.....	66, 906
.....	925	Clifton, M.A.....	1412
Chevalier, Y.....	623	Clifton, R.J.....	174
Chi, M.....	1601	Clough, R.W.....	240, 1986
Chi, R.M.....	2517	Coe, C.J.....	1479
Chia, C.Y.....	81	Coetzee, G.J.....	1278
Chiang, C.K.....	2550	Cohen, R.....	451
Chiang, S.L.....	2590	Cole, J.D.....	1113
Chiang, Yao-Chung.....	1638	Cole, R.A.....	345
Chiang, Y.C.....	2106	Cole, S.R.....	2598
Chiarito, V.P.....	1530	Cole, III, J.E.....	512
Chiba, Y.....	535	Colijn, H.....	2028
Childs, D.W.....	292, 1148	Collette, A.C.....	2179
.....	1155, 1505	Collins, R.L.....	1423
Childs, E.....	964	Coltman, J.W.....	896
Childs, M.E.....	2109	Combesure, A.....	107
Chino, A.....	980	Compton, W.H.....	1012
Chipman, R.....	2468	Comstock, T.R.....	1423
Chiu, C.S.....	2367	Conle, A.....	2375
Cho, D.....	1864	Conlisk, A.T.....	1938
Cho, U.Y.....	1104	Conrad, P.....	1829
Choi, D.....	1711	Consigny, H.....	362
Choi, S.R.....	68	Constantinou, M.C.....	489, 795
Chokshi, J.V.....	1455	.....	1127
Chona, R.....	2403	Cook, N.J.....	1085
Chonan, S.....	2546	Cook, W.H.....	1242
Chong, F.S.....	215	Cookson, R.A.....	118
Chopra, A.K.....	496, 1287	Corazao, M.....	994
.....	1529	Cordner, D.A.....	279
Chopra, I.....	1870	Corelli, D.....	1419
Chou, Chaur-Mi.....	1425, 1493	Corley, J.E.....	2032, 2176
Chou, K.C.....	1354	Cornell, C.A.....	646, 1669
Chou, Yuan-Fan.....	1426, 1714	Corotis, R.B.....	1354
Choudhuri, S.K. Roy.....	145	Cortinez, V.H.....	1904
Chow, C.Y.....	2367	Costantino, C.J.....	938
Chow, L.C.....	674	Costley, R.D.....	985
Chow, Y.K.....	1741, 1952	Cottin, N.....	1469
Christ, W.....	1823	Coulton, A.C.....	1018
Christian, R.S.....	575	Counihan, J.....	2292
Christopher, P.A.T.....	363	Countryman, M.....	1594
Chu, F.H.....	1448, 1700	Coupry, G.....	1648
Chu, Kuang-Han.....	503, 1517	Crabb, H.C.....	1536
Chu, K.H.....	1784	Craggs, A.....	1026, 1277

Craig, J.I..... 2193
 Craig, Jr., R.R..... 1471, 2150
 2589
 Craighead, I.A..... 2049
 Cramer, H..... 1799
 Cramond, A.J..... 1929
 Crandall, S.H..... 112, 1203
 Crawford, M.L..... 109
 Crawley, E.F..... 1213, 2484
 2485, 2515, 2607
 Crema, L.B..... 1723
 Croker, M.D..... 2420
 Crolla, D.A..... 2048
 Crooljans, M.T.M..... 202
 Crouse, C.B..... 832
 Crowley, J..... 1241, 1438
 1442, 1691
 Crowley, J.R..... 1701
 Crowley, S..... 1718
 Crowley, S.M..... 1437, 1701
 Cudworth, C.J..... 208
 Cummings, A..... 1921
 Cummings, J.M..... 1027
 Cummings, R.M..... 521
 Cuntze, R..... 1271
 Curfman, R.L..... 2007
 Curling, L.R..... 2306, 2321
 Curreri, P..... 259
 Currie, I.G..... 2275
 Curtis, D.J..... 1082
 Cuschieri, J.M..... 674, 774
 Cutts, D.G..... 990, 1570
 2415
 Cveticanin, L..... 1762
 Cveticanin, L.J..... 231
 Czajkowski, E..... 1153
 Czekajski, C..... 725, 726
 1597
 Czichos, H..... 48

- D -

Daemen, J.J.K..... 350, 351
 352, 354
 Dahl, M.D..... 2570
 Dahlberg, T..... 1783
 Daimaruya, M..... 1328
 Dainton, L.J..... 118
 Dale, A.K..... 2048
 Daly, A..... 1090
 Dambra, F..... 894
 Damname, G..... 605
 Damongeot, A..... 894
 Danek, O..... 4, 1042
 1206, 2397
 Danesi, A..... 252

Daniel, B.R..... 400
 Daniel, I.M..... 159
 Daniels, R..... 1546
 Danielski, J..... 588
 Darbre, G.R..... 470, 671
 Darcing, D.W..... 1775
 Darvizeh, M..... 756
 Dasgupta, G..... 2216
 Dat, R..... 893
 Datta, S.K..... 944, 1002
 1349, 1527
 Davenport, A.G..... 663, 1353
 David, J.W..... 855, 1502
 Davies, M..... 1052
 Davies, M.R.D..... 2514
 Davies, T.G..... 1285
 Davies, W.G.R..... 1767
 Davis, A.D..... 2559
 Davis, M.W..... 1561
 Davis, R.E..... 575
 Davis, S..... 2052
 Dawkins, W.P..... 652
 Dawson, G..... 2002
 Dawson, T.H..... 1807
 Day, W.B..... 1758
 De, S..... 1001, 1945
 de Belleval, J.F..... 2341
 de Hoop, A.T..... 1194
 de Luis, J..... 2484
 De Natalini, L.B..... 2287
 de Silva, C.W..... 625
 Deane, A..... 349
 Debenedetti, M..... 261
 Decha-Umphai, K..... 729, 2554
 Dede, M..... 2110
 Dede, M.M..... 1212
 Deel, J.C..... 1698
 Deepak, D..... 1825
 Degallaix, S..... 1227
 Degrez, G..... 776
 Dehghanyar, T..... 613
 DeJong, R.G..... 2434
 DeKraker, A..... 202
 Del Vescovo, D..... 1647
 Delage, P..... 2123
 Delsanto, P.P..... 2120
 DeMay, A..... 1649
 Demic, M..... 2061
 Demsetz, L.A..... 1595
 Denbigh, P..... 959
 Dendrou, B..... 2425
 Deng, Y.C..... 2142
 Dennis, Jr., B.G..... 1601
 Dentry, C.S..... 2231
 Deobald, L.R..... 2132
 Der Kiureghian, A..... 763, 1356
 1358, 1378

Derucher, K..... 374
 Desanghere, G..... 1456
 Desouza, J.A.M.F..... 859
 DesRochers, C.G..... 2230
 Desseaux, A..... 2326
 Detroux, P..... 86
 DeVilbiss, C.E..... 1853
 Dewhurst, R.J..... 1245
 Dhalla, A.K..... 2302
 Diachok, O..... 2116
 Diana, G..... 220
 Diarra, C.M..... 1310
 Dibner, B..... 248
 Dietrich, C..... 1045
 Dieulesaint, E..... 813
 Diez, G..... 1904
 Dill, J.F..... 1579, 1580
 Dimitriadis, E.K..... 332
 Dimsdale, J.S..... 188
 Dinyavari, M.A.H..... 2519
 Dittmar, J.H..... 11
 Dixon, J..... 2015
 Dixon, M.W..... 697
 Djoldasbekov, U.A..... 199
 Djukic, D.S..... 424
 Dobb, Jr., A.B..... 271
 Dobbs, N..... 2110
 Dobson, B.J..... 1458
 Dodge, F.T..... 2588
 Dogan, M..... 1212
 Dokainish, M.A..... 2305
 Dolling, D.S..... 1380
 Dombrowski, T.R..... 1141
 Dominy, J..... 1865
 Domke, H..... 1897
 Don, C.G..... 1929
 Donaldson, I.S..... 2328
 Done, G.T.S..... 892
 Dong, S.B..... 1165, 2281
 Donovan, D.A..... 165
 Doong, Ji-Liang..... 80, 311
 1619
 Doorman, K.W.F.M..... 102
 Dossing, O..... 1831
 Doughty, S..... 1501, 1506
 Douglas, B.M..... 664
 Dourson, S.E..... 2601
 Dovener, D..... 254
 Dover, W.D..... 1294
 Dow, J.O..... 2476
 Dowding, C.H..... 1521
 Dowling, A.P..... 2346
 Dowling, N.E..... 135
 Doyle, J.P..... 1000, 1459
 Drake, M.L..... 691, 1574
 2237
 Drewitz, H.-J..... 2437

Du, Gongchen..... 948
 Du, Qingxuan..... 1038
 Du, S..... 1658
 Dubas, M..... 2202
 Dube, F..... 1030
 Dubigeon, S..... 1327
 Dudderar, T.D..... 1676
 Dufour, R..... 1268
 Dugan, D.C..... 1833
 Dugundji, J..... 657
 Dukkipati, R.V..... 464
 Dumir, P.C..... 587, 754
 1628, 1902, 1905, 2099
 Dundar, C..... 666
 Dundurs, J..... 45
 Dunlop, J.I..... 2066
 Dusing, J.A..... 2388
 Dutta, A..... 168
 Dvorak, F.A..... 2405
 Dwyer, R.F..... 1545
 Dyer, D..... 197
 Dzhupanov, V.A..... 2227
 D'Angelo, III, C..... 2203
 D'Archangelo, J.M..... 1175
 D'Eleuterio, G.M.T..... 2493
 D'Souza, A.F..... 1830
 D'Spain, G.L..... 964

- E -

Earnshaw, J.C..... 2067
 Eastep, F.E..... 250, 2483
 Eberle, F..... 1533
 Ebrahimi, N.D..... 1272
 Ecker, H..... 207
 Eckstrom, C.V..... 2470
 Edin, E..... 331
 Edney, S.L..... 751
 Edwards, A.A..... 1216
 Edwards, P.R..... 1850
 Eggenberger, A.J..... 41
 Ehlers, F.E..... 2471
 Eicher, N..... 182, 429
 644
 Eierman, R.G..... 1066
 Eilker, R..... 2597
 Eisler, R..... 1544
 Eitzen, D.G..... 603
 Ek, L..... 1337
 Elber, W..... 1195, 1339
 1668
 Elchuri, V..... 1494
 Elder, R.L..... 7
 Elishakoff, I..... 734, 910
 Elkholy, I.A..... 662
 Ellaithy, H.M..... 1627, 2211

Ellingwood, B..... 526
 Elliott, K.B..... 50, 390
 1427
 Elliott, L..... 57, 58
 Elliott, S.J..... 1920
 Ellyin, F..... 373, 1026
 1277
 Elmallawany, A..... 2094
 Elsabee, F..... 335
 Elvey, J.S.N..... 883
 Elwany, M.H.S..... 562
 El-Hifnawy, L.M..... 670
 El-Raheb, M..... 1643
 El-Sayed, M..... 1270
 El-Sharnouby, B.E..... 672
 Eman, K.F..... 148, 626
 2025, 2026
 Embling, L.V..... 279
 Emery, A.F..... 68
 Enflo, B.O..... 1189, 2114
 Engels, R.C..... 1444
 Engelstad, R.L..... 1637
 Engja, H..... 233
 Engle, R.M..... 377
 English, R.W..... 1861
 Enochson, L..... 2390
 Erdman, A.G..... 2198
 Erfurt, F..... 462
 Ericsson, L.E..... 1837, 2465
 2531
 Eriksson, L.J..... 2566
 Ermer, D.S..... 379
 Eronini, I.E..... 704, 708
 Errett, A.J..... 1274
 Eshleman, R.L..... 227, 2021
 2172
 Esparza, E.D..... 356, 1375
 Etemad, S..... 68
 Etsion, I..... 1954, 2085
 Ettles, C.M.McC..... 543
 Evans, B.B..... 2012
 Evans, B.F..... 1067
 Evans, R.B..... 1655
 Evan-Iwanowski, R.M..... 747, 748
 1357, 1385
 Evensen, H.A..... 2386
 Everett, L.J..... 723
 Eversman, W..... 656, 1120
 1990
 Ewart, T.E..... 767
 Ewins, D.J..... 1009, 1686

Faby, E.Z..... 970
 Fafitis, A..... 142
 Fahy, F.J..... 155, 1914
 Fairley, T.E..... 2044
 Falco, M..... 291
 Falkenberg, R.J..... 524
 Faller, J.E..... 2244
 Fallon, W.J..... 2277
 Fallstrom, P.G..... 498
 Farid, M.M..... 157
 Farmer, M.G..... 1965
 Farvacque, M..... 20
 Faulkner, M.G..... 2395
 Favre, B.M..... 245
 Federn, K..... 366
 Fehrecke, H..... 1860
 Feijo, F..... 1453
 Feik, R.A..... 1678
 Felgenhauer, H.P..... 1469
 Felsen, L.B..... 1673
 Feng, W.Q..... 1334
 Fenton, D.A..... 929
 Fenton, R.G..... 66, 906
 Fenves, G..... 496, 1287
 1529
 Fenves, G.L..... 2221
 Ferguson, N.S..... 682
 Ferla, M.C..... 338, 2115
 Ferman, M.A..... 2460
 Ferrante, E..... 1119
 Ferritto, J.M..... 482
 Fettahlioglu, O.A..... 735, 757
 Fey, T.A..... 2588
 Fiala, C..... 26
 Ficcadenti, G.M..... 297, 1161
 Fidell, S..... 1556
 Field, N..... 1016
 Field, N.L..... 165
 Fillod, R..... 1435, 1702
 Finch, R.D..... 1128
 Finney, J.M..... 2231
 Fiorito, R..... 1338
 Firth, D..... 1914
 Fischer, B..... 1829
 Fischer, E..... 1263
 Fischer, G..... 2072
 Fischer, G.E..... 1055
 Fischer, M.J..... 970
 Fitzpatrick, J.A..... 2328
 Flack, R.D..... 193
 Fleck, N.A..... 1228
 Fleeter, S..... 2409
 Fleischer, H..... 361, 1367
 Fleming, D.P..... 367, 615
 2579
 Fleming, J.E..... 1423
 Fleming, J.F..... 2206

- F -

Faber, W..... 397
 Fabunmi, J.A..... 797, 2587

Flesch, R. 1781
 Fletcher, J.N. 2447
 Flint, W.H. 2427
 Flower, W.C. 2509
 Floyd, R.E. 1681
 Flynn, D.R. 1930
 Foet, J. 1227
 Foist, B.L. 1332
 Folkestad, G. 1094
 Ford, D.M. 2510
 Formenti, D.L. 1433
 Forys, A. 554
 Foss, S.K. 1400
 Foster, Jr., J.C. 1158
 Foster, R.M. 2139
 Fothergill, D.J. 2446
 Fourney, W.L. 2403
 Foutch, D.A. 572
 Fox, M.J.H. 733
 Fox, R.L. 2170, 2171
 Franchi, E.R. 438
 Francis, D.T.I. 2563
 Frandsen, S. 1135
 Frank, K.H. 288
 Franklin, D.E. 1020
 Franklin, S.N. 1548
 Franssens, G.R. 812
 Fransson, T. 222
 Franzel, R.A. 1676
 Fraser, K.F. 1877
 Frater, J.L. 903
 Freathy, P. 1221
 Frene, J. 1152
 Frey, D. 831
 Freymann, R. 689
 Frick, T.M. 2337
 Fricke, A. 1142
 Friedman, P. 688
 Friedmann, P.P. 517, 1308
 2519
 Friedrich, H. 1406
 Frigne, P. 2412
 Friley, J.R. 2300
 Fujii, S. 1765
 Fujikawa, T. 224, 1151
 1566, 1720
 Fujimoto, T. 916, 2422
 Fujioka, T. 677
 Fujita, K. 2083
 Fujita, Y. 395
 Fukata, S. 2523
 Fukuda, M. 2112
 Fukumoto, Y. 1170
 Fukushima, A. 2140
 Fuller, C.R. 687, 2461
 2560
 Fulton, J.W. 1068

Fulton, R.E. 2595
 Furey, M.J. 50, 1874

- 6 -

Gabriel, K. 1882
 Gad, E.H. 2523
 Gade, S. 2122
 Gad-el-Hak, M. 2234, 2381
 2459
 Gagnon, J.O. 1178, 2321
 Gajdos, J. 15
 Gajewski, A. 2279
 Galczynski, R. 873
 Gallardo, V.C. 219
 Gallo, A.M. 1494
 Galmes, J.M. 223
 Gam, R. 2052
 Ganapathi Rao, D. 1513
 Gandhi, M.L. 587, 754
 1628, 1905, 2099
 GangaRao, H.V.S. 468
 Gangwani, S.T. 275
 Gans, R.F. 364
 Gantenbein, F. 20, 23, 24
 1102, 1289, 1292
 Gaonkar, G.H. 1847
 Garba, J.A. 431, 1595
 Garcia-Vadillo, E. 1828
 Gardner, J.W. 890
 Garg, V.K. 503, 1517
 1784
 Garner, G. 982
 Garnier, J.L. 99
 Garrelick, I.M. 512
 Garrett, L.B. 2498
 Garrison, G.R. 1360
 Gartshore, I.S. 2269
 Garza, R. 2155
 Gasch, R. 213
 Gates, S. 2261
 Gaughan, A.J. 282
 Gaul, L. 1988
 Gaunaurd, G.C. 2101
 Gautesen, A.K. 45
 Gay, D. 725, 726
 1597
 Gaylard, M.R. 398, 790
 Gazanhes, C. 99
 Gazarian, A. 1126
 Gazetas, G. 795
 Gbadeyan, J.A. 722
 Ge, Lifeng. 2387
 Geib, Jr., F.E. 2379
 Geisler, D. 1718
 Geissler, W. 1944

Gelos, R.....	2287	Goibert, Y.....	1611
Genin, J.....	506	Gold, E.....	399
Genoux, G.....	895	Goldar, D.....	1011
George, A.W.....	248	Goldman, A.....	631
Georgiadis, C.....	1919	Goldman, S.....	638
Georgiadis, H.G.....	576	Goldsmith, W.....	1173
Geraets, L.H.....	86	Goldstein, A.....	2384
Gerasch, W.J.....	1167	Gomuc, R.....	141
Gerlach, C.R.....	115	Gondhalekar, V.....	1140, 1320
Gersch, W.....	1993	Gong, K.F.....	1472
Gewig, W.....	1317	Gong, Qingxiang.....	514
Geschwindner, Jr., L.F.....	466	Good, J.K.....	2612
Geyer, J.F.....	993	Good, M.C.....	1779
Ghafory-Ashtiany, M....	104, 669	Goodwin, M.J.....	211
Ghazy, E.....	2418	Goorjian, P.M.....	357
Ghiringhelli, G.L.....	2191	Gordon, D.F.....	2353
Ghlaim, K.H.....	1466	Gorman, D.J.....	310
Ghodsi, A.....	431	Gorman, T.E.....	1701
Ghosh, A.....	350, 353	Goshtasbpour, M.....	1316
Ghosh, M.....	1273	Gossmann, E.....	1256
Ghosh, S.K.....	73, 425	Goto, H.....	791
Giambanco, F.....	973	Goto, M.....	1363
Gibbons, M.P.....	892	Gottenberg, W.G.....	2166
Gibert, P.....	1950	Goudreau, G.L.....	1105
Gibert, R.J.....	23, 24	Gould, J.D.....	2466
.....	2326, 2329	Govindachar, S.....	278
Gibian, G.L.....	2506	Gowda, S.S.....	550
Gibson, R.F.....	1473, 2132	Goyder, H.G.D.....	827, 2312
.....	2135	Goydke, H.....	1352
Giergiel, J.....	1237	Grady, D.E.....	777, 1379
Giesige, Jr., R.J.....	2384	Graham, T.A.....	1298
Gilbert, C.....	530	Graison, J.....	2017
Gilbert, J.A.....	1676	Grandhi, R.V.....	1748
Gilbert, K.E.....	1655	Grandt, Jr., A.F.....	1224
Gillis, P.P.....	1158	Gras, B.T.....	245
Gimenez, J.G.....	1828, 1462	Grassie, S.L.....	679
.....	2053	Gravelle, A.....	362
Ginoux, J.J.....	776	Green, D.....	128
Ginsberg, J.H.....	1942	Green, L.H.....	968
Girgis, S.F.....	1547	Greene, R.R.....	963, 2126
Giri, J.....	915	Greenman, M.J.....	304
Girshowich, S.....	1397	Greenwood, J.C.....	158
Giuliani, S.....	1048	Gregory, D.L.....	630, 1164
Gladwell, I.....	923	.....	1994
Glaser, F.W.....	336	Gregory, R.D.....	923
Glaser, R.J.....	2496	Griffin, J.H.....	1265, 1600
Gleed, G.P.....	304	.....	1665
Glenn, L.A.....	82	Griffin, J.M.....	438
Glew, C.A.W.....	1028	Griffin, K.E.....	1115
Godon, J.L.....	2320	Griffin, M.J.....	2044
Goebel, T.P.....	1113	Griffin, O.M.....	2272
Goel, C.S.....	65	Griffin, R.B.....	634
Goenka, P.K.....	706, 707	Grigoriu, M.....	645
Goeransson, P.....	1169	Grinberg, N.M.....	1225
Goff, R.J.....	2594	Grosserode, P.....	2476
Gohar, R.....	49	Grossmann, E.....	1996
Gohring, E.....	1815	Grossmann, K.....	1774

Gross-Thebing, A..... 971
 Grosveld, F.W..... 1305, 1844
 1845, 2540
 Grotberg, J.B..... 1980
 Grover, E.C..... 2015, 2418
 Gruber, J.A..... 1031
 Grubisic, V..... 1968, 2072
 Grundmann, H..... 1786, 1995
 Grundy, P..... 2280
 Grunewald, H.J..... 1299
 Grunnet, J.L..... 407
 Guanfu, Wang..... 1511
 Guedes Soares, C..... 502
 Guerin, B..... 339
 Guilbaud, D..... 23
 Guillot, J.C..... 1384
 Gunneskov, O..... 2246
 Gunter, E.J..... 207
 Guntur, R.R..... 464
 Guo, Tong-Yi..... 858
 Gupta, A.K..... 783, 784
 785, 1330,
 Gupta, B.K..... 544
 Gupta, D.C..... 1903
 Gupta, K.K..... 428, 1032
 Gupta, N.K..... 1849
 Gupta, P.K..... 1579, 1580
 Gupta, U.S..... 2286
 Gupton, P.S..... 1024
 Gurgoze, M..... 2089
 Guruswamy, P..... 357
 Gutierrez, R.H..... 740, 746
 920, 2096
 Guttalu, R.S..... 170, 1884
 Guy, R.W..... 950, 1649
 Guyomar, D..... 771, 1657
 Gvildys, J..... 882, 1293

- H -

Haas, W.M.B..... 256
 Haber, S..... 1954
 Haberle, M..... 254
 Habib, I.S..... 977
 Hackett, R.M..... 1853
 Hackney, J.R..... 2453
 Hadsagh, F.Y..... 187
 Hadden, J.A..... 2037
 Haddow, A.G..... 1962
 Haddow, J.B..... 1589
 Haftka, R.T..... 2486
 Hagiwara, I..... 2433
 Hagiwara, N..... 453, 454
 Hahn, E.J..... 365, 1211
 Haines, D.J..... 1056
 Haines, R.S..... 2529

Haisler, W.E..... 2491
 Hale, A.L..... 1739, 2480
 Hales, F.D..... 2445
 Hall, F.L..... 522
 Hall, K.C..... 2515
 Hall, R.L..... 2217
 Hall, S.A..... 1033
 Hall, W.J..... 40
 Hallander, J.E..... 755, 1907
 Hallauer, W.L..... 2239
 Hallauer, Jr., W.L..... 2486
 Halle, H..... 2313, 2319
 Haller, H.W..... 13
 Haller, R..... 831
 Haller, R.L..... 358
 Halleux, J.P..... 863
 Halliwell, R.E..... 2117
 Halloran, J.D..... 2011
 Hallquist, J.O..... 1261
 Hamilton, J.F..... 172
 Hammer, W..... 1967
 Hammond, J.K..... 676
 Hampel, G.A..... 371
 Hamza, E.A..... 1577
 Hanagud, S..... 2534, 2583
 Hanagud, S.V..... 1157, 2193
 Hancock, G.J..... 1092, 2207
 Hanenkamp, W..... 1967
 Hanff, E.S..... 1475
 Hanke, M..... 2615
 Hankey, W.L..... 1309
 Hanks, P..... 2014
 Hanna, D.S..... 1412
 Hansen, J.S..... 1728, 2174
 Hansen, L.L..... 2478
 Hanson, D.B..... 1121, 1937
 Hanson, W.J..... 371
 Hara, F..... 2271
 Hara, H..... 1097
 Hara, K..... 806
 Harada, S..... 2082
 Harada, Y..... 713
 Hardin, J.C..... 1871
 Harding, J..... 2156
 Hardtke, H.J..... 1258
 Harker, R.G..... 1728, 2174
 Harley, R.G..... 1278
 Harman, D.J..... 663
 Haroun, M.A..... 317, 1627
 2211, 2294, 2295
 Haroun, N.M..... 2211
 Harris, C.E..... 1401
 Harris, F.G..... 2231
 Harris, J.A..... 2525
 Harris, R.E..... 2305
 Harrison, P.M..... 690
 Harrison, R.F..... 676

Hart, G.C.....	1522	Herzum, N.....	2597
Hart, J.D.....	664	Heshmat, H.....	54, 55
Hart, J.J.....	1082	.....	1575
Hart, J.L.....	31	Hetsroni, G.....	2329
Hartie, M.S.....	307	Hicks, D.L.....	2184
Hartwig, P.L.....	1959	Hida, A.....	2
Hartzman, M.....	259	Higashihara, H.....	585
Haruyama, Y.....	1322, 1582	Higuchi, K.....	739
Hasegawa, E.....	981, 2556	Hill, D.....	322
Hasegawa, M.....	673	Hill, R.G.....	1532
Hashemi, Y.....	210, 1764	Hilmy, S.I.....	1609
Hashimoto, H.....	52, 709	Hinchey, M.J.....	1298
.....	710, 2521	Hiramoto, M.....	951
Hashimoto, M.....	889	Hirano, F.....	711
Hashimoto, S.....	1007	Hirano, M.....	805
Hashin, Z.....	138	Hirata, M.....	1862
Hashmi, M.S.J.....	762	Hirotsu, T.....	678
Haslinger, K.H.....	260, 1235	Hisada, K.....	1341
.....	1966, 2323	Hitchcock, J.E.....	2370
Hassan, J.F.....	1508	Ho, C.M.....	2234
Hassan, S.Z.....	1017	Hobbs, G.K.....	836, 1201
Hatakeyama, K.....	609, 610	Hobson, D.E.....	2225, 2299
Hattori, S.....	380	Hochrein, Jr., A.A.....	368
Hauersperger, D.....	2591	Hodgson, T.H.....	2380
Haughton, D.M.....	1916	Hodson, H.P.....	2411
Haviland, J.K.....	794	Hoepfner, D.W.....	1667
Hawkins, N.M.....	64	Hofe, R.V.....	2414
Haworth, R.....	2417	Hoff, C.J.....	191
Hayashi, K.....	583, 745	Hofmann, H.....	437
Hayek, S.I.....	755, 1907	Hohl, G.H.....	1858
Haylen, P.T.....	1092	Hohlsiepe, U.....	1787
Hays, Jr., W.D.....	2567	Hoi, Bui Ngok.....	1207
Heathcock, C.R.....	1091	Holasut, S.....	2154
Hebener, H.....	1798	Holberg, B.....	1983
Hedrick, J.K.....	1827, 1864	Holehouse, I.....	741, 802
Heermann, C.R.....	2421	Holger, D.K.....	1452
Hegde, U.G.....	1125	Hollings, J.P.....	593, 594
Heidari, M.A.....	847, 1249	.....	595
Heinke, H.....	1975	Hollis, S.J.....	964
Heller, M.....	2232	Holm, D.....	799
Helpenstein, H.....	1490	Holmberg, R.....	1540
Hemdai, J.F.....	505	Holmer, C.I.....	2558
Hemingway, N.G.....	1816	Holmes, P.....	184
Hempel, W.G.....	12	Holmes, P.J.....	169, 171
Hemstock, I.....	253	Holmes, R.....	1140, 1212
Hendricks, S.L.....	867	.....	1320
Hendry, S.R.....	2267	Honda, H.....	1180
Henle, M.....	833	Hong, D.P.....	2395
Henseleit, O.....	474	Honma, T.....	242
Heo, H.....	1446	Hononjeff, R.....	1556
Herberling, II, C.....	85	Hood, M.J.....	329
Herklotz, G.....	1369	Hooke, C.J.....	211
Herlufsen, H.....	423	Hooper, W.E.....	232
Hernried, A.G.....	779	Hooshyar, M.A.....	1675
Herraty, A.G.....	1136	Hooven, M.D.....	2524
Herrick, J.W.....	1422	Hoppmann, II, W.H.....	1374
Herrmann, G.....	580, 919	Horacek, J.....	2133

Hori, Y. 293
 Horner, G.C. 2487
 Horsten, J.J. 1112, 1116
 Horstmann, M. 2385
 Horta, L.C. 2613
 Horton, D.L. 2048
 Horvath, S. 504, 2444
 Hoshiya, M. 650, 1039
 Hothersall, D.C. 2347
 Hou, Zhiqiang. 1432
 Houjoh, H. 2081, 2118
 Houlston, R. 1693, 2230
 Houwink, R. 1116
 Howe, M.S. 608, 2568
 Howell, T.M. 2430
 Howes, B.C. 902
 Hoyniak, D. 2409
 Hsi, W.H. 2528
 Hsieh, B.J. 2388
 Hsieh, Ching-Chieh. 1749
 Hsieh, C.C. 190, 1489
 Hsu, C.S. 170, 1884
 Hsu, Hong-Yuan. 1392
 Hsu, N.N. 2153
 Hu, A. 2400
 Hu, C.Y. 1510
 Hu, Sau-lon James. 994
 Huang, H. 1932
 Huang, J.S. 301
 Huang, K.H. 1165, 2281
 Huang, S.N. 42
 Huang, T. 1810
 Huang, T.C. 1334
 Huang, et al., Tao. 606
 Hubbard, H.H. 2030
 Huber, A. 437
 Huck, M. 619, 1107
 Hudde, H. 1362
 Huff, D.L. 2316
 Hughes, P.C. 518, 2493
 Hughes, T.J.R. 175
 Hui, D. 76, 262, 1617
 Hulbert, G.M. 85
 Humphrey, V.F. 2541
 Hundal, M.S. 955
 Hung, C.K. 850
 Hung, C.M. 2127
 Hung, L.H. 301
 Hunt, D.L. 1303
 Hunter, Jr., N.F. 1467
 Huo, Shao Cheng. 1430
 Huppmann, W.J. 2442
 Huseyin, K. 852, 1253, 2605
 Hushmand, B. 1101
 Hussaini, M.Y. 1232, 1492
 Huston, R.L. 1034, 2257
 2494

Hutchins, D.A. 1373
 Hutchinson, J.R. 314, 1616
 Huth, H. 2084
 Hutton, D.V. 573
 Hutton, P.H. 640
 Hwang, Chyi. 858
 Hwang, H. 881
 Hwang, Y.F. 1910
 Hwong, X.Q. 872
 Hyde, D.W. 1941

- I -

Iannuzzelli, R.J. 1759
 Ibrahim, R.A. 1446, 1709
 Ibrahim, S.R. 1695, 1744
 2582
 Ichimonji, M. 452
 Ichinomiya, O. 2555
 Ida, M. 414, 1061
 Idelsohn, S.R. 668, 856, 2190
 Igarashi, T. 1363, 1972
 Iguchi, M. 677
 Igusa, T. 1356, 1358
 Ih, Jeong-Guon. 1933
 Iida, H. 201
 Iida, K. 341
 Ikeda, S. 2407
 Ikeda, T. 2, 447
 2010
 Ikeuchi, K. 616, 987
 Ikeuchi, T. 395
 Ikushima, T. 242
 Ilanko, S. 2553
 Illg, W. 1339
 Inagawa, M. 2422
 Ingall, J.P. 2375
 Inger, G.R. 349
 Ingham, T.J. 974
 Inman, D.J. 1391, 2188
 Inoue, J. 167
 Inoue, Y. 1720
 Inversini, C. 2223
 Irani, F.D. 1969
 Irie, T. 299, 589
 590, 922, 930, 2297
 Irretier, H. 270, 683
 Irwin, G.R. 2403
 Isaacson, M.Q. 2228
 Ishida, S. 678, 2362
 Ishida, Y. 2, 71
 447, 2010
 Ishihara, K. 654, 2247
 Ishihara, T. 1074
 Ishii, K. 1039
 Ishikawa, A. 1403

Ishiwata, R..... 566
 Ishizaki, H..... 1097
 Issa, H.I..... 1008
 Ito, H..... 16, 673
 Ito, Y..... 2423
 Ivanov, V.I..... 1246
 Iwai, Y..... 380
 Iwan, W.D..... 239, 1033
 1590
 Iwanami, K..... 531
 Iwankiewicz, R..... 302, 1329
 Iwasaki, F..... 678
 Iwasaki, T..... 1879
 Iwata, Y..... 44
 Iwatsubo, T..... 224, 228
 449, 1154
 Izbicki, J.L..... 1926
 Izumi, H..... 2112

- J -

Jackson, E.D..... 1587
 Jackson, J.E..... 697
 Jackson, Jr., J.E..... 1939
 Jacobs, R.W..... 2168
 Jacobson, E.N..... 1497
 Jacobson, I.B..... 248
 Jacobson, M.J..... 766, 2350
 Jain, R..... 556
 Jain, S.K..... 480
 Jain, V.K..... 1738
 Jakeman, R.W..... 1323
 James, E.C..... 2369
 Jamil, F..... 1394
 Jarosch, J..... 272
 Javadian-Gilani, A..... 571
 Javidinejad, M..... 1423
 Jayasuriya, S..... 1181
 Jeal, R.H..... 1667
 Jedryszek, J..... 1763
 Jeelani, S..... 133
 Jega, P..... 895
 Jegley, D.C..... 2542
 Jemielniak, K..... 459
 Jendryschik, J..... 2201
 Jendrzeczyk, J.A..... 88, 328
1347, 1635, 1636, 2314
 Jenista, J.M..... 1124
 Jenkins, C.J..... 279
 Jennewein, M..... 2071
 Jenny, R.J..... 718
 Jensen, J.J..... 1094
 Jensen, P.S..... 180
 Jerry, B..... 1073
 Jezequel, L..... 818
 Jiang, B.L..... 1391

Jin, Xianding..... 508
 Jing, H.S..... 637
 Jingu, T..... 1341
 Jirapongphan, M..... 1776
 Joachim, C.A..... 2040
 Joehnik, J.M..... 288
 Johansson, B.R..... 2042
 Johnke, K.D..... 1860
 Johnson, C..... 1512
 Johnson, D.K..... 2317
 Johnson, J.J..... 326
 Johnson, L.W..... 321
 Johnson, N..... 2052
 Johnson, R.O..... 296
 Jolles, M..... 2355
 Joly, P..... 1384
 Jonas, G.H..... 2356
 Jonasson, J.E..... 331
 Jones, A.D..... 456
 Jones, D..... 2172
 Jones, D.I.G..... 1267, 1431
 Jones, H.W..... 1373
 Jones, N..... 1130, 1131, 1957
 Jones, N.P..... 1590
 Jones, R..... 631, 2232, 2252
 Jones, R.E..... 2447
 Jones, S.E..... 1158
 Jonsson, M..... 2152
 Jordan, E.H..... 124
 Jordan, R.W..... 1891
 Jorgenson, J.S..... 30
 Joyce, J.D..... 2601
 Ju, F.D..... 1644
 Juang, Jer-Nan..... 2613
 Julyk, L.J..... 499
 Jumper, E.J..... 2370
 Junger, M.C..... 512
 Junqi, Yan..... 659
 Just, E..... 1234
 Jzy, W..... 2107

- K -

Kaba, S.A..... 1605
 Kabe, A.M..... 393
 Kabele, D.F..... 2013
 Kadlec, J..... 1533
 Kadrnka, K.E..... 2599
 Kaernae, T..... 2256
 Kagawa, N..... 1154
 Kahana, A..... 798
 Kahoe, M.W..... 2056
 Kailath, T..... 1981
 Kaiser, B..... 1645
 Kaishun, Wang..... 2034
 Kaji, S..... 951

Kajio, Y.....	2433	Kawai, R.....	224, 228, 1154
Kakatsios, A.J.....	860	Kawai, Y.....	547
Kakiuchi, T.....	1154	Kawakami, T.....	295
Kakubari, T.....	284	Kawakami, Y.....	2140
Kakusho, O.....	2113	Kawakita, K.....	711
Kakutani, T.....	348, 909	Kawanoto, S.....	980
Kaladi, V.....	87	Kawasaki, A.....	1363
Kalinowski, A.J.....	2357	Kawashima, S.....	916
Kalme, J.S.....	949	Kawashima, T.....	2338
Kalnins, A.....	2293	Kawata, K.....	1007
Kalyanasundaram, N.....	2147	Kay, S.....	1741
Kalyanasundaram, S.....	2491	Kaya, A.C.....	804
Kamat, M.P.....	2543	Kaya, F.....	203
Kamelander, G.....	1103	Kaye, M.C.....	884
Kameoka, T.....	1151	Kaza, K.R.V.....	536, 699, 913
Kanga Fomo, B.....	1732	.....	1571, 2516
Kamijo, K.....	1769, 1856	Kazanaki, T.....	1322, 1582
Kamikawa, N.....	577	Keegan, D.F.....	2250
Kamiya, Y.....	1778	Keer, L.M.....	997
Kamman, J.W.....	1034, 2257	Kehoe, M.W.....	1843
Kammer, D.C.....	2489	Keim, M.....	1997
Kana, D.D.....	108, 405, 2588	Keiner, W.....	2597
Kanamaru, K.....	2435	Keith, M.W.....	1842
Kanayama, Y.....	1217	Kelen, P.....	217
Kanehara, T.....	2083	Kellenberger, W.....	216
Kaneko, S.....	293	Keller, J.M.....	1412
Kanki, H.....	295	Kelly, J.J.....	2560
Kannan, R.....	1594	Kelly, J.M.....	487, 545, 2243
Kapania, R.K.....	488, 758	Keltie, R.F.....	2088, 2380
Kaptouom, E.....	1732	Kendall, D.P.....	1625
Karabalis, D.L.....	491	Kenner, V.H.....	637
Karadag, V.....	47	Keresztes, A.....	2444
Karagozova, D.D.....	2227	Kernbichler, K.....	1781
Karal, K.....	1915	Kerr, A.D.....	2213
Karanian, L.A.....	2500	Keshavarzian, M.....	1179, 1922
Kareem, A.....	1296	Kettleborough, C.F.....	634
Karlin, B.E.....	1985	Keyvan, S.....	639
Karlsson, L.....	1885	Khader, N.....	3
Karmel, A.....	247	Khan, M.R.....	1046
Karnopp, D.....	1315	Khan, Z.....	129
Karr, A.F.....	1354	Khandoker, J.U.....	877
Karsan, D.I.....	1295	Khatib-Rahbar, M.....	440
Kasahara, T.....	1414	Khot, N.S.....	2483
Kasuba, R.....	903	Khozeimeh, K.....	2215
Katinas, V.J.....	2315	Khurana, O.P.....	1011
Kato, J.....	1972	Khurasia, H.B.....	1340
Kato, M.....	195, 448, 1811	Kibens, V.....	2111
Kato, S.....	1202	Kidd, H.A.....	844
Kato, Y.....	16	Kidder, R.E.....	82
Katsaitis, S.....	121	Kido, T.....	2435
Katz, A.....	2092	Kief, M.....	1546
Kausel, E.....	494	Kiehl, W.....	1772
Kaushal, A.....	1280	Kielb, R.....	1761
Kaushal, S.C.....	1666	Kielb, R.E.....	406, 536, 699, 913
Kawabata, N.....	1139	.....	1620, 1621, 2516
Kawagoe, S.....	1348	Kienholz, D.A.....	1707
Kawai, K.....	673	Kiger, S.A.....	1528, 1941

Kikuchi, F.....	416	Kobayashi, S.....	918
Kikuchi, K.....	453, 454	Kobayashi, Y.....	922
Kikuchi, N.....	318	Koch, S.....	1352
Kikuchi, Y.....	61	Kodama, S.....	2140
Kim, Chang-Boo.....	1327	Koenig, K.....	1013
Kim, Chang-Ho.....	1148	Koester, D.J.....	1569
Kim, C.....	111	Koga, T.....	1880
Kim, D.H.....	1104	Koh, Aik-Siong.....	493
Kim, Kang Nyoun.....	1345	Koh, C.G.....	495
Kim, Ki-Ook.....	2614	Kohring, M.....	1512
Kim, Kwang Sic.....	1345	Koide, T.....	715, 2584
Kim, K.J.....	148, 626, 2219	Moike, H.....	654
Kim, P.Y.....	408, 2175	Koinig, H.....	1103
Kim, Y.S.....	1104	Koizumi, T.....	1255
Kindel, J.....	1689	Kojic, M.....	1819
Kindig, W.....	2618	Kojima, H.....	1, 1894, 2068
King, B.J.....	438	Kojima, N.....	2112
King, J.H.....	880	Kojima, O.....	2209
King, J.L.....	2263	Kolkka, R.W.....	1251
King, R.....	1895, 2270	Kollegger, J.....	1785
Kingery, C.N.....	344	Kollek, W.....	2020
Kinoshita, Y.....	2413	Koller, A.....	1519
Kinra, V.K.....	1958	Kominami, K.....	2083
Kiral, E.....	666	Kondo, E.....	596
Kirchweger, K.....	2016	Kondou, T.....	2523
Kirk, C.L.....	2429	Kong, F.R.....	394
Kirk, N.E.....	822	Konstadinopoulos, P... 1114, 1302	
Kirk, R.G.....	409	Koopmann, G.H.....	1134
Kirkhope, J.....	2105	Kopff, P.....	1523
Kiryu, K.....	1880	Kopriva, D.A.....	1232, 1492
Kisilev, S.....	1126	Kortum, W.....	1109
Kitagawa, G.....	1993	Kosawada, T.....	318, 752
Kitagawa, M.....	2475	.....	932, 1344
Kitahara, T.....	528	Koss, L.L.....	591
Kitamura, S.....	1180	Kostem, C.N.....	2293
Kitis, L.....	651, 1863, 2194	Kot, C.A.....	258, 2388
Kivity, Y.....	759	Kotera, T.....	2185
Kiyono, S.....	2130	Koterayama, W.....	303, 567
Kjerengstroen, L.....	131	Koutselos, T.....	2259
Klahs, J.W.....	1436, 1710	Koyama, H.....	2576
Klauber, R.D.....	867	Koyuncu, B.....	2067
Klaus, M.H.....	2343	Kozin, F.....	132, 2477, 2606
Klega, V.....	2376	Kozina, M.M.....	880
Kliman, V.....	1396	Kramer, E.....	221
Klingmuller, O.....	1797	Kratzig, W.B.....	1787
Klompas, N.....	60	Krause, W.....	1185, 1369
Kloster, M.....	300	Krenk, S.....	421, 2246
Knuesner, M.F.....	2237	Krenz, R.A.....	2439
Knita, J.....	1387	Krettek, O.....	1832
Kniazev, V.....	1126	Krieg, R.....	25
Knight, Jr., N.F.....	820	Kriegsmann, G.A.....	1979
Knothe, K.....	971, 1187	Krishna, R.....	1310
Knox, L.D.....	705	Krishnamurthy, K.....	1982
Ko, P.L.....	1917	Krishnamurthy, N.....	810
Kobarg, J.....	474	Krogmann, P.....	1197
Kobayakawa, M.....	2518	Krynicky, K.....	194
Kobayashi, A.S.....	999, 1223	Kryter, R.C.....	166

Ku, C.H..... 872, 1724
 Kuang, J.H..... 1963
 Kuba, F..... 2103
 Kubiak, J.A.....1507, 2157, 2162
 Kubo, A..... 2077
 Kubomura, K..... 2475, 2592
 Kubrusly, C.S..... 432
 Kucukay, F..... 286, 1584
 Kudarauskas, S.J..... 1182, 1183
 Kukretti, A.R..... 1008
 Kulak, G.L..... 1326
 Kulak, R.F..... 26
 Kulig, T.S..... 212
 Kumakiri, T..... 1811
 Kumano, S..... 457
 Kumar, A..... 835, 2208
 Kumar, Ch.R..... 2099
 Kumar, S..... 1108, 2091
 Kumar, V..... 1903
 Kumar, V.A..... 1666
 Kumaraswamy, K..... 810
 Kung, Chaw-Hua..... 1646
 Kung, C..... 1752
 Kunz, R.K..... 582
 Kuo, A.S..... 266, 2585
 Kuo, A.-Y..... 998
 Kuo, Chin-Po..... 2482
 Kuo, C.P..... 2496
 Kuo, Jui-Fang..... 273
 Kuperman, W.A..... 338, 2115
 Kuppusamy, T..... 74
 Kuramochi, S..... 2530
 Kurath, P..... 129
 Kuribayashi, M..... 1923
 Kurohashi, M..... 224
 Kurtz, R.J..... 640
 Kurz, B..... 2615
 Kurzweil, L.G..... 43
 Kusama, H..... 1170
 Kushida, G..... 753
 Kussoy, M.I..... 2127
 Kutt, T.V..... 2586
 Kwak, B.M..... 2526
 Kwak, E.H..... 1104
 Kwatny, H.G..... 1250
 Kwok, K.C.S..... 1092
 Kyosti, A..... 1337

- L -

Lachenmaier, S..... 1818
 Ladeveze, P..... 1491
 Laerum, M..... 233
 Lagsse, P.E..... 812
 Lagnese, T.J..... 1569
 Lahey, B..... 2001

Lahey, R..... 1750
 Lai, Hsin-Yi..... 1075
 Lakhtakia, A..... 1613
 Lakshmikantan, K..... 1666
 Lakshminarayana, B..... 223
 Lal, R..... 2286
 Lalanne, C..... 372, 1219
 Lallement, G..... 1463, 1696
 1702
 Lally, R.W..... 1419
 Lalonde, F..... 1481
 Lam, P.C..... 2316
 Lamberson, S.E..... 2282, 2495
 Lambert, O..... 2055
 Lambert, R.G..... 130, 1756
 Landgraf, R.W..... 134, 2440
 Lang, C.M..... 2020
 Lang, H.A..... 760
 Langdon, R.M..... 2389
 Lange, C..... 1406
 Lange, C.G..... 1979
 Langley, R.S..... 244, 501
 Lanz, M..... 2191
 Lardner, R.W..... 1381
 Laroze, S..... 1597
 Laschet, A..... 445
 Lau, J.H..... 1893
 Lau, S.L..... 154, 924, 925
 Laub, G.H..... 2248
 Lauchle, G.C..... 958, 1188
 Lauffer, J.P..... 1284
 Laura, P.A..... 1904
 Laura, P.A.A..... 297, 312, 740
 746, 920, 1161, 1742
 1904, 2096, 2287, 2552, 2602
 Law, B..... 842
 le Torrivellec, M..... 1611
 Leatherwood, J.D..... 2502
 Lecce, L..... 1111, 1119
 1174
 Lee, Byung-Ho..... 1933
 Lee, C.L..... 975, 2575
 Lee, Dong-Guen..... 477
 Lee, D..... 960
 Lee, Jang Moo..... 1623
 Lee, J.D..... 1658, 1722
 Lee, K..... 1745
 Lee, Lee-Jen..... 2216
 Lee, L.J..... 1640
 Lee, L.R..... 1243
 Lee, O.W.K..... 1153
 Lee, Seng-Lip..... 472
 Lee, W.H..... 1940
 Lee, Y..... 172
 Leehey, P..... 2276
 Lees, A.W..... 285, 1794
 Lefebvre, D..... 1735

Lehmann, G..... 200
 Lehnhus, R..... 238
 Leipholz, H.H.E..... 77, 78
 176, 1883
 Leira, B.J..... 1789
 Leissa, A.W..... 76, 742, 931
 1620, 1621, 1624, 1626, 2538
 LeKuch, H..... 530
 Lellep, J..... 320
 Lempert, B..... 253
 Lenhoff, A.M..... 2183
 Lenzi, A..... 2136
 Leon Saenz, R.T..... 600
 Leonard, F.W..... 970
 Leonard, J.W..... 1806
 Leong, Y.M.M.S..... 294, 1150
 Lesueur, C..... 339
 Letens, U..... 1362
 Leu, M.C..... 1776
 Leung, D.D..... 902
 Leung, E.C.N..... 1873
 Leung, J.G.M..... 1833
 Leung, K.L..... 1618
 Leung, R.K..... 1708
 Leuridan, J.M..... 628
 Lever, J.H..... 2330, 2331
 Levy, B.C..... 1981
 Levy, D.C..... 1278
 Levy, N..... 1173
 Lewy, S..... 1848
 Leyendecker, E.V..... 478
 Li, H.-P..... 373
 Li, Yongchi..... 347
 Li, Zhongyuan..... 2065
 Liang, G.C..... 832
 Licht, T.R..... 1415
 Liebowitz, H..... 382, 1658
 Liebrock, L.M..... 2184
 Liebst, B.S..... 1872
 Lieu, Inn-Wei..... 1425
 Lii, Mirng-Ji..... 1722
 Liljeroos, A..... 1679
 Lilley, D.T..... 897
 Lin, C.J..... 744, 1614
 Lin, C.-W..... 1634
 Lin, D.X..... 793, 2373
 2391, 2544
 Lin, Heng-Chih..... 2093
 Lin, J..... 436, 1355
 Lin, Li-Chung..... 1449
 Lin, P.T..... 30
 Lin, W..... 997
 Lin, W.H..... 88, 1191
 Lin, Y.J..... 1892
 Lin, Y.K..... 430, 475
 1222, 1573, 2212
 Lin, Z.H..... 872

Lindquist, M.R..... 945, 946
 Liolios, A.A..... 1978
 Lips, K.W..... 1855
 Lipvin-Schramm, S..... 2110
 Liu, Chang..... 513
 Liu, C.R..... 2022, 2023, 2024
 Liu, D.D..... 1900
 Liu, J.C.C..... 1374
 Liu, T.M..... 2022
 Liu, Wen David..... 2214
 Liu, Wing Kam..... 1035, 2366
 Liu, Ying-li..... 1717, 1736
 Liu, Y.S..... 872
 Livshits, D..... 734, 910
 Ljunggren, S..... 313, 1901
 Lloyd, T.M..... 2594
 Loeber, J.F..... 298
 Loeffler, Jr., A.L..... 264
 Loewen, T..... 1022
 Loewenthal, S.H..... 869
 Loewy, R.G..... 3
 Loh, C.L..... 917
 Long, L.N..... 2006
 Lorenz, G..... 1771
 Lory, M.K..... 2238
 Lotfy, A.A..... 77, 78
 Lou, Meng-lin..... 497
 Lovell, E.G..... 1592, 1637
 Lowe, J.M..... 1029
 Lowery, R.L..... 2612
 Lu, L.K.H..... 1276
 Lu, Naiyan..... 1716
 Lu, You-fang..... 1443, 1733
 Lu, Z.H..... 218
 Lucas, J.G..... 336
 Lucibello, P..... 1647
 Ludtke, K..... 8
 Luk, Yiu W..... 1698
 Lukowski, F.J..... 1417, 1418
 Lund, J.W..... 214
 Lundstrom, A..... 498
 Luongo, A..... 728
 Lupson, W.F..... 2059
 Lutes, L.D..... 994
 Luttges, M.W..... 2368
 Lutz, J.D..... 2491
 Lyon, R.H..... 1041
 Lyons, J.A..... 695

- M -

Ma, D.C..... 882, 1293
 Ma, Guolin..... 2426
 Ma, Zen-tong..... 1443, 1733
 Mabie, H.H..... 50, 1874
 Macaskill, C..... 767

Macaulay, M.....	2456	Mark, W.D.....	2547
MacBain, J.C.....	1620, 1621	Marsh, D.....	128
.....	2520	Marshall, K.D.....	1460
Macdougall, I.....	7	Marshall, P.W.....	28
Mace, B.R.....	1886	Marshall, S.E.....	1307
Machek, J.....	2376	Marston, P.L.....	770, 1672
Machida, S.....	1341	Martin, F.A.....	281
Machin, A.S.....	2059	Martin, G.R.....	832
Machiyama, T.....	2530	Martin, H.R.....	845, 1751
Macioce, D.J.....	1719	Martin, J.B.....	2265
MacIsaac, B.D.....	164	Martin, K.F.....	1238, 1466
MacInnon, M.J.....	11	Martin, L.N.....	2053
MacLeod, G.....	2254	Martin, R.....	834, 1014
Maday, C.J.....	1985	Martinez, D.R.....	630, 1164
Madigosky, W.....	1338	.....	1994
Madsen, P.H.....	421, 1135	Martinez, R.....	512
Maeda, Y.....	547	Martinez-Sanchez,	1153
Maekawa, K.....	1896	Martinovic, Z.N.....	2486
Maewal, A.....	2104	Marui, E.....	1202
Maetzawa, S.....	1881	Marulo, F.....	1111, 1119
Maga, L.J.....	716	.....	1174
Magliaro, A.A.....	1472	Maruyama, A.....	2569
Magliozzi, B.....	1121	Maruyama, K.....	2555
Magrab, E.B.....	621	Marynowski, K.....	194
Mahan, J.R.....	2461	Maskew, B.....	2405
Mahin, S.A.....	436, 571	Maslenikov, O.R.....	1105
.....	1355, 1605	Mason, J.P.....	1871
Mahrenholtz, O.....	588, 683	Masri, S.F.....	828
Maidanik, G.....	716	Masrur, M.A.....	868
Maier, B.....	1815	Massmann, H.....	290, 1147
Maison, B.F.....	1083	Massoud, M.....	1010, 1735
Majette, M.....	38	Mastorakos, M.....	2325
Majima, O.....	745	Masuda, N.....	2435
Makay, E.....	712	Masure, B.....	894
Mal, A.K.....	2284	Mateescu, D.....	2342
Malanoski, S.B.....	2600	Matolcsy, M.....	2441
Maleci, G.....	1704	Matsuhisa, H.....	1133
Malik, S.N.....	95	Matsui, K.....	1822
Malley, J.O.....	63	Matsumoto, S.....	56, 1880
Malmuth, N.D.....	1113	Matsumoto, T.....	563
Malone, J.B.....	1116	Matsuo, K.....	1348
Mamalis, A.G.....	2054	Matsushita, O.....	414, 1061
Mancuso, J.R.....	905	Matsuzaki, Y.....	2469
Mandarini, S.....	1111	Matta, K.....	389
Mani, N.K.....	2393	Matthews, J.F.....	2602
Mann, J.Y.....	2059, 2232	Matyssek, G.....	1817
Manning, S.D.....	62, 2528	Maul, D.J.....	2269
Manojlovic, V.....	1819	Maurer, J.....	213
Manolakos, D.E.....	2054	Mavriplis, D.....	2332
Mantegazza, P.....	2191	Mayberry, W.A.....	248
Marcellin J., S.....	2157	Mayhew, H.C.....	241
Marchelek, K.....	461	Maynard, K.P.....	1457
Marcolini, M.A.....	1370	May-Miller, R.....	360
Marenco, G.....	291	Maze, G.....	1926
Margolis, D.....	1315	Mazumdar, J.....	322, 574
Margolis, D.L.....	507, 1316	Mazzoni, A.....	1549
Mark, B.....	2310	McAlister, K.W.....	2055

McCain, W.E.....	1841	Miller, A.K.....	630, 1164
McCarthy, W.C.....	837	Miller, C.A.....	938
McCarty, R.E.....	31, 36, 2559	Miller, D.S.....	1836
McCloskey, T.H.....	209, 712	Miller, D.W.....	2485
McClure, W.B.....	1380	Miller, E.H.....	1059
McConville, J.B.....	862	Miller, G.R.....	375
McC. Ettles, C.M.....	1559	Miller, L.A.....	2063
McDaniel, O.H.....	2570	Miller, M.L.....	1642
McDougal, W.G.....	2354	Miller, R.K.....	828, 847
McGrath, J.D.....	2618	Miller, V.R.....	691
McGrath, J.F.....	2184	Mills, J.....	1556
McHugh, J.D.....	2009, 2165	Mills-Curran, W.C.....	1259
McKay, J.T.....	57, 58	Millwater, H.R.....	2352
McLain, C.E.....	162	Milne, R.D.....	1705
McLean, D.....	1750, 2001	Miloh, T.....	887
McLean, L.J.....	1211	Milsted, M.G.....	2014
McMaster, W.H.....	1049	Mimmi, G.....	291
McNeill, D.J.....	1650	Minamihara, H.....	648
Meacham, H.C.....	2593	Minnetyan, L.....	695, 778
Mechel, F.P.....	1352	Mirels, H.....	1943
Meckl, P.....	1515	Mirza, S.....	1343
Medallah, K.Y.....	1079	Misawa, H.....	2140
Medvec, A.....	641	Misra, A.K.....	1908, 2296
Medwin, H.....	964, 965	Mitchell, C.G.B.....	2041, 2438
Mehta, K.C.....	1088	Mitchell, D.....	64
Mei, Chuh.....	750, 2550	Mitchell, J.G.....	1477
Mei, C.....	729	Mitchell, J.S.....	1248
Meijer, J.J.....	1112	Mitchell, Larry D.....	1753, 1754
Meirovitch, L.....	1840, 2611	Mitchell, Leanne D.....	1439, 1753
Mengi, Y.....	666	.....	1754
Mengle, V.G.....	703	Mitchell, L.D.....	50, 390, 855
Menq, Chia-Hsiang.....	1600	.....	1427, 1439, 1502
Menz, P.....	1975	Mitschke, M.....	1867
Mercado, R.....	836, 1201	Mittler, J.P.....	861
Merckx, K.R.....	1532	Miura, F.....	1791
Meskouris, K.....	1787	Miura, Y.....	2019
Mesquita, L.C.....	2543	Mixson, J.S.....	1834, 1845
Messiter, A.F.....	815	.....	2565, 1844
Metcalf, V.L.....	2540	Miyachika, K.....	546, 713, 714
Metcalfe, A.V.....	787, 1560	Miyake, Y.....	1139
Metwalli, S.M.....	1453, 1713	Miyano, H.....	1361
Metwally, H.M.....	1270, 1499	Miyazaki, N.....	592
Meyer, F.....	1252	Miyoshi, Y.....	2113
Meyn, E.H.....	406	Mizubayashi, H.....	1220
Meynart, R.....	1236	Mizuno, K.....	341
Meyr, H.....	1897	Mlakar, P.F.....	345
Meyyappa, M.....	2193, 2583	Mo, O.....	1808
Michaels, J.E.....	772, 2095	Moan, T.....	1808
Michelberger, P.....	504, 2444	Modi, V.J.....	37, 2372
Michimura, S.....	453, 454	Moe, G.....	1812
Michon, J.C.....	1461	Moeen-Vaziri, N.....	1198
Middleton, D.....	100	Moehle, J.P.....	17, 18, 473
Midha, A.....	1144, 1145, 1146	Moeller, M.J.....	2276
Milberg, J.....	1773	Mohanani, V.....	2181
Milenkovic, V.....	1016	Mohr, D.G.....	1213
Milford, R.V.....	2298	Mohring, W.....	775
Millarke, P.R.....	1376, 1377	Mokhtar, M.O.A.....	988, 1324, 1876

Mokry, M..... 1474
 Molin, N.-E..... 1337
 Molinaro, R..... 362
 Molnar, A.J..... 161
 Molnar, C..... 2441
 Monasa, F.F..... 2452
 Monczkowski, U..... 1045
 Mondy, R.E..... 865, 1564
 Mook, D.T..... 1114, 1302
 1962
 Noon, F.C..... 169
 Moore, G.G..... 2449
 Moore, L.F..... 1795
 Moore, T..... 875, 1281
 1729
 Morehead, III, J.C..... 2080
 Moren, P..... 346
 Moreno, A..... 1931
 Morfey, C.L..... 1351
 Mori, A..... 56, 1322, 1582
 Mori, E..... 1923
 Mori, H..... 56, 616, 987
 1322, 1582
 Mori, N..... 2082
 Mori, T..... 995
 Morii, S..... 410
 Morimitsu, T..... 1970
 Morisako, K..... 2362
 Morishita, M..... 1403
 Morita, S..... 1896
 Morita, Y..... 678
 Morlock, C.R..... 350, 354
 Morris, D.H..... 1401
 Morris, R.E..... 406
 Morrison, D..... 2038
 Morrison, D.G..... 1604
 Morton, P.C..... 1482
 Morton, P.G..... 2074
 Mosher, M..... 276, 537
 Mosquera, J.M..... 1602, 1663
 Mostaghel, N..... 486
 Mostofi, A..... 49, 2251
 Mote, Jr., C.D..... 2203
 Moulin, D..... 27
 Mouri, B..... 29
 Moustafa, K.A.F..... 1269
 Moyer, D.S..... 1505
 Moyer, Jr., E.T..... 1159, 2090
 Mukherjee, A..... 1503
 Mukherjee, K..... 934
 Mulcahy, T.M..... 2273, 2339
 Muller, F.H..... 1786
 Muller, M.R..... 2392
 Muller, P..... 344
 Muller, R..... 1786
 Munday, E.G..... 801
 Muniz, B..... 2468

Munse, W.H..... 548
 Murakami, H..... 1531, 2241
 2242
 Muramoto, Y..... 590, 2297
 Murashige, A..... 2576
 Murayama, Y..... 52
 Murphy, B.T..... 866, 1504
 Murphy, D.P..... 972
 Murphy A.E..... 1507
 Murphy, Jr., N.R..... 1857
 Murthy, P.L.N..... 1050
 Musial, M..... 133
 Musson, B.G..... 1421, 2148
 Muszynska, A..... 198, 870
 1137, 1267
 Muthuswamy, V.P..... 2218
 Myers, M.K..... 91, 92
 Mykura, J.F..... 208

- N -

Nacozy, P.E..... 39
 Nadolski, W..... 1333
 Naehring, T..... 437
 Naess, A..... 186, 1805
 Nagabhushanam, J..... 1847
 Nagaike, M..... 391, 457
 Nagamatsu, A..... 152, 153, 391
 ... 395, 453, 454, 457, 816, 2604
 Nagaraj, V.T..... 249
 Nagaraja, K.S..... 2057, 2058
 Nagarajan, P..... 541
 Nagarkar, B.N..... 1128
 Nagata, M..... 1531
 Nagata, S..... 1039
 Nagaya, K..... 1, 75, 83
 1894, 2068, 2260, 2407
 Nagurka, M.L..... 1827
 Nair, P.S..... 579
 Nair, S.S..... 1393
 Nair, V.V.D..... 1295
 Naitoh, M..... 1328
 Najji, A..... 418
 Nakagawa, M..... 1516
 Nakahara, I..... 1341
 Nakai, M..... 535, 1868
 Nakajo, Y..... 583
 Nakamura, K..... 889
 Nakamura, M..... 2069
 Nakamura, S..... 1813
 Nakane, N..... 1361
 Nakano, M..... 2253
 Nakano, Y..... 6, 284
 Nakasako, N..... 1186
 Nakayama, H..... 1217
 Nakayama, T..... 1970

Nakayama, Y..... 1782
 Nalecz, A.G..... 506
 Nanayakkara, M.A..... 2457
 Nanyaro, A.P..... 1110
 Naraykin, O..... 1126
 Nardone, S.C..... 1472
 Narita, Y..... 931, 1626
 2548
 Nash, P.T..... 356, 1375
 Nash, R..... 35
 Nath, Y..... 587, 754
 1628, 1902, 1905
 Nathoo, N.S..... 2166
 Natke, H.G..... 1167, 1469
 1999
 Natvig, J..... 642
 Nayfeh, A.H..... 305, 307
 1114, 1204, 1302, 1948, 2401
 Neathammer, R.D..... 255
 Neerhoff, F.L..... 384, 388
 Nefske, D.J..... 1537, 1820
 2432
 Neilson, I.D..... 2451
 Neise, W..... 1134
 Nelson, C.C..... 717, 1149
 Nelson, H.D..... 1498
 Nelson, P.A..... 1920
 Nelson, P.M..... 2070, 2503
 Nelson, R.C..... 1117, 1124
 Nelson, T.A..... 492
 Neto, A.R..... 1554
 Netuka, H..... 119, 612
 Neuman, C.P..... 1076
 Neuss, C.F..... 1083
 Newland, D.E..... 1096
 Newman, Jr., J.C..... 139
 Newman, J.N..... 510, 685
 Newman, J.S..... 1851, 1852
 Newsom, J.R..... 1839
 Ng, C.T..... 327
 Ng, K.F..... 941
 Ng, S.F..... 315
 Ni, R.G..... 793, 2544
 Nicholas, J.C..... 1576
 Nicholson, J.W..... 2408, 2549
 2580
 Nickel, D.A..... 1422
 Nickell, R.E..... 117
 Niemann, H.-J..... 1095
 Nieter, J.J..... 1770
 Nieters, J.M..... 1685
 Nigam, H..... 156
 Nilsson, A.C..... 2100
 Nilsson, F..... 33
 Nimmo, N.A..... 2499
 Ninomiya, A..... 2209
 Nishida, K..... 2569

Nishimoto, K..... 410
 Nishimura, K..... 610
 Nishimura, M..... 648, 936
 Nishimura, N..... 620
 Nishimura, T..... 805
 Nishiwaki, H..... 1765
 Niziol, J..... 554
 Noah, S.T..... 634, 1757
 Nogiwa, Y..... 1361
 Noll, T.E..... 250
 Nomura, Y..... 2113
 Nonami, K..... 44, 564
 Nonishi, T..... 864
 Noor, A.K..... 2537
 Nopporn, C..... 823
 Norberg, C..... 2327
 Nord, A.R..... 1284
 Nordmann, R..... 290, 1147
 1997
 Nordsve, N.T..... 2404
 Norris, A.N..... 2146
 Norsworthy, T.H..... 2505
 Norton, M.P..... 84
 Notohardjono, B.D..... 379, 800
 Nour-Omid, B..... 1986
 Nour-Omid, G..... 642
 Novarini, J.C..... 965
 Nowinski, J.L..... 386, 720
 2098
 Nurick, G.N..... 2151
 Nypan, L.J..... 1138

- 0 -

Obal, M.W..... 2583
 Obermeier, F..... 775
 Oberhuber, P..... 1800, 1801
 Ochmann, M..... 1177
 Ockert, C.E..... 257
 Oda, S..... 546, 713, 714
 715, 2584
 Ofierzynski, M..... 1832
 Ogawa, H..... 936
 Ogawa, M..... 1414
 Oguni, Y..... 1791
 Ogushwitz, P.R..... 1484, 1485
 1486
 Ohashi, H..... 566, 1070
 Ohira, N..... 1133
 Ohmiya, K..... 1822
 Ohnuma, S..... 2422
 Ohsawa, H..... 410
 Ohta, H..... 195
 Ohta, M..... 609, 610
 648, 957, 1186
 Ohtomi, K..... 2289

Paul, D.K..... 420
 Paul, J..... 2252
 Payne, F.M..... 1117
 Paz, M..... 1465
 Pearce, B.K..... 697
 Pearson, M.L..... 1495
 Peecken, H..... 1581
 Peecken, H.J..... 1324
 Pegg, N..... 2230
 Pekau, O.A..... 19, 2364
 Pell, R.A..... 2231, 2232
 Pelle, J.P..... 1491
 Pelmear, P..... 253
 Pelot, R..... 1026, 1277
 Peloubet, Jr., R.P..... 358
 Pendleton, R.L..... 218
 Peng, H..... 2088
 Penny, J.E.T..... 211
 Penny, P.H.G..... 1824
 Penoyre, S..... 2511
 Penzien, J..... 21
 Perangelo, H.J..... 1838
 Peretti, L..... 2490
 Peretz, D..... 759
 Peroni, I..... 1723
 Perrault, J..... 1077
 Perricone, F..... 1022
 Perrone, N..... 308
 Perry, III, B..... 2462
 Person, M..... 267
 Persoon, A.J..... 1112
 Peters, J.M..... 2537
 Petersmann, N..... 849
 Peterson, L.D..... 2607
 Petersson, B..... 401
 Petot, D..... 2055
 Petronijevic, Z..... 1819
 Petroski, H.J..... 2091, 2102
 Petternella, M..... 1949
 Pettigrew, M.J..... 2325
 Petty, S.P.F..... 2450
 Petyt, M..... 817
 Pfeifer, M.S..... 1076
 Pfeiffer, F..... 110
 Pfeiffer, R..... 272
 Pham, T.C..... 718
 Philippacopoulos, A.J..... 938
 Phipps, D.A..... 282
 Pi, W.S..... 2513
 Piaggio, R..... 1549
 Pielorz, A..... 1333
 Pierce, A.D..... 962
 Piety, K.R..... 2178, 2179
 Pilkey, W.D..... 10, 651
 1863, 2194
 Pillai, T.A.K..... 101
 Pinazzi, F..... 2129

Pinkus, O..... 54, 55, 1875
 Pinnington, R.J..... 696
 Pintz, A..... 903
 Piotrowski, J..... 2008
 Piotrowski, J.D..... 2160
 Piquette, J.C..... 343
 Piranda, J..... 1435, 1702
 Pivovarov, I..... 2532
 Pizzamiglio, M..... 1549
 Pizzigoni, B..... 220, 291
 Plaut, R.H..... 321
 Plesha, M.E..... 2186
 Pluchino, S..... 622, 624
 Plummer, M.C..... 1707
 Plumtree, A..... 1399
 Pochyly, F..... 612, 119
 Polizzotto, C..... 383, 627
 Pomereneing, D.J..... 405
 Pommereit, K.G..... 1215
 Pook, L.P..... 289, 1395
 Popov, E.P..... 63
 Popp, K..... 681
 Poppel, R..... 1991
 Porat, I..... 451
 Porter, M.B..... 2351
 Posner, E.I..... 1057
 Potiron, A..... 725, 726, 1597
 Pototzky, A.S..... 1839, 2462
 Potter, R..... 1434
 Powell, C.L..... 1424
 Powell, G.H..... 593, 594
 595, 943
 Powers, E.J..... 1711
 Powers, J..... 771, 1657
 Praefcke, R.O..... 1796
 Prakash, J..... 48, 1581
 Prater, Jr., G..... 1393
 Preisser, J.S..... 1120, 1990
 Prevost, J.H..... 173, 1479
 Price, S.J..... 2303, 2310
 2332, 2333
 Priddy, T.G..... 1359
 Priede, T..... 2015, 2418
 Pritchard, B.N..... 1098
 Pritchard, R.W..... 1518
 Prossler, E..... 1490
 Provan, J.W..... 1218
 Prucz, Z..... 243
 Prussing, J.E..... 1573
 Pu, S.L..... 1629

- Q -

Qamaruddin, M..... 1788
 Qian, F.B..... 1334
 Qian, Zu-wen..... 956

Quek, Ser-Tong..... 472
 Queval, J.C..... 107
 Quigley, W.I..... 1019
 Quinn, M.C..... 1936
 Quirt, J.D..... 1283
 Qureshi, T.B..... 898

- R -

Raabe, G..... 1352
 Rabin, U.H..... 1548
 Rabins, M.J..... 1181
 Racic, Z..... 2076
 Rackwitz, R..... 1996
 Rades, M..... 2383
 Radhakrishnan, V.M..... 1226
 Radon, J.C..... 1230
 Radwan, H.R..... 1455
 Raghavan, T..... 2218
 Ragulskis, K..... 1184, 1209
 Rajagopal, K.R..... 908
 Rajamani, A..... 1273
 Rajaram, S..... 1747
 Rajkumar, B.R..... 1969
 Raju, I.S..... 139
 Rakheja, S..... 1563
 Rakhimov, E.R..... 199
 Rakhit, A.K..... 2027
 Rakhmatullaev, A.S..... 199
 Ramamurti, V..... 249, 542
 1513, 1761
 Raman, H..... 2562
 Ramulu, M..... 1223
 Rand, O..... 2073
 Randall, R..... 1541
 Randall, R.B..... 287
 Ranganath, D..... 586
 Ranky, M.F..... 59
 Rao, D.K..... 1431
 Rao, D.L.P..... 1108
 Rao, J.S..... 268, 1319, 2410
 Rao, M.K..... 1536
 Rao, M.S..... 579
 Rao, R.S..... 246
 Rao, S.S..... 736, 1551
 Rao, V.V.R..... 268
 Rao Dasary, A.M..... 1503
 Raphanel, J.L..... 306
 Raptis, A.C..... 1191
 Rashed, A.A..... 239
 Rasmussen, B..... 2100
 Rasmussen, G..... 1021, 1420
 Rasmussen, K.B..... 2564
 Raspet, R..... 1546
 Ratcliffe, C.P..... 1429
 Rauch, A..... 1500, 1706

Rauch, F..... 2468
 Rauscher, G..... 1781
 Rautenbach, W..... 196
 Ray, H..... 933
 Ray, R.P..... 237
 Ray, S.K..... 1224
 Raynaud, J.L..... 1702
 Reason, B.R..... 2522
 Reavis, J.R..... 2337
 Reddy, A.S.S.R..... 1310, 1553
 2497
 Reddy, J.N..... 74, 1911
 2097, 2285
 Reddy, P.J..... 249
 Reddy, V.R..... 1451
 Reding, J.P..... 1837
 Redman-White, W..... 829
 Reed, J.W..... 160
 Rega, G..... 665, 728
 Rehak, M..... 2574
 Reich, M..... 881
 Reichelt, W..... 1106
 Reid, S.R..... 2267, 2458
 Reif, Z..... 874, 875
 1729, 1281
 Reinberg, E..... 1397
 Reinhardt, W.A..... 1028
 Reiss, E.L..... 1980, 2351
 Reiss, R..... 2610
 Ren, L.X..... 2278
 Ren, Shu-chu..... 635
 Renfro, E.M..... 1793
 Renkey, E.J..... 945
 Repaci, A..... 727
 Repick, E.P..... 2431
 Reynolds, D.D..... 523, 524, 525
 Ricciardiello, L..... 2129
 Rice, J.M..... 1526
 Rice, J.M..... 1987
 Rice, R.S..... 1417, 1418
 Richards, E.J..... 2136
 Richards, T.R..... 1568
 Richardson, M.D..... 2460
 Richardson, M.H..... 1433
 Ricketts, D..... 2288
 Rickley, E.J..... 1852
 Rieger, N.F..... 246, 871, 2144
 Rienstra, S.W..... 94, 2340
 Riff, R..... 178
 Riggs, H.R..... 1802
 Riley, B.S..... 2511
 Riley, D.R..... 2198
 Rimer, M..... 2468
 Rincon, A..... 1405
 Rinker, R.L..... 2244
 Ripoche, J..... 1926
 Ritchie, R.O..... 376

Rizzo, F.J..... 1366
 Rizzo, S..... 973
 Robbins, D.H..... 1859
 Robert, G..... 2283
 Robert, M..... 2210
 Roberts, J.B..... 203, 647
 Robertson, J.S..... 2350
 Robinson, J..... 1947
 Robinson, M.C..... 2368
 Robinson, R.T..... 970
 Robson, J.D..... 788
 Roche, R.L..... 27
 Rocklin, G.T..... 1241, 1442
 1694, 1701
 Rodack, M..... 2052
 Rodeman, R..... 1359
 Rodman, C.W..... 2593
 Rogers, J.D..... 1388
 Rogers, L..... 1389
 Rogers, L.C..... 691
 Rogers, R.J..... 898
 Rohani, B..... 435
 Rombult, P.A..... 1559
 Romilly, N..... 598
 Rosario, E..... 2120
 Rosen, A..... 540, 2073
 Rosenberg, J..... 798
 Rosenhouse, G..... 1641
 Rosenkilde, C.E..... 1942
 Ross, C.A..... 1242
 Ross, T.J..... 2266, 2268
 Rossmannith, H.P..... 1671
 Rothhirsch L.A..... 2157
 Rotoloni, D.F..... 2302
 Rousseaux, P..... 340
 Row, D.G..... 593, 594, 595
 Rowe, W.B..... 215
 Rowe, W.S..... 2471
 Royer, D..... 813
 Rozmarynowski, B..... 1887
 Rubin, L.I..... 467
 Rucker, W..... 1798
 Rudd, G.E..... 1123
 Rudd, J.L..... 62, 2528, 2585
 Ruddy, A.V..... 281, 841
 Ruhnke, A..... 614
 Ruiz, C..... 549, 2154
 Ruo, S.Y..... 1116
 Ruoss, C.W..... 260
 Ruscheweyh, H..... 1100
 Russell, D.L..... 2365
 Russell, L.T..... 1373
 Russell, M.F..... 2018, 2417
 Rymer, P.C..... 1734

Sa, T.A..... 315
 Sablik, M.J..... 1642
 Sabot, J..... 2283
 Sachse, W..... 1927
 Sackman, J.L..... 779, 974
 Sadd, M.H..... 1526, 1987
 Sadek, A.W..... 1790
 Sadek, E.A..... 912
 Sadek, I..... 1898
 Sadek, I.S..... 1168
 Sadek, M.M..... 2563
 Safar, K.N..... 2391
 Safar, Z.S..... 51, 1324, 1876
 Saff, C.R..... 2460
 Sageau, J.F..... 2210
 Saha, P..... 505
 Sahinkaya, M.N..... 280, 1214
 Saigo, M..... 449
 Saiidi, M..... 664
 Saito, E..... 650
 Saito, H..... 597
 Saito, K..... 1813
 Saito, S..... 891
 Saka, K..... 2156
 Sakae, N..... 596
 Sakai, F..... 936
 Sakai, T..... 2130, 2141
 Salama, M..... 2482
 Salas, M.D..... 1232, 1492
 2125
 Saleh, N.A..... 2015
 Salikuddin, M..... 93, 400
 Salje, H..... 1818
 Salm, J..... 205
 Salman, F.K..... 1499
 Salmon, M.A..... 1313
 Samaras, E..... 2399
 Samarasekera, H..... 1023
 Samuelson, L.A..... 33
 San Andres, L..... 1210
 Sander, H..... 143
 Sandford, M.C..... 2470
 Sandifer, J.B..... 2308, 2316
 Sandover, J..... 527
 Sandstrom, R.E..... 191
 Sankar, B..... 1662
 Sankar, S..... 2138
 Sankar, T.S..... 1015
 Santini, A..... 761
 Saravanamuttoo, H.I.H..... 164
 Sarfeld, W..... 213
 Sari, N..... 1386
 Sarahia, S..... 941
 Sarrailhe, S.R..... 511
 Sas, P..... 773, 2121

Sasaki, Y.....	230	Schulkin, M.....	1360
Sassi, H.....	828	Schultz, K.J.....	1846
Sathymoorthy, M.....	309, 749	Schumacher, R.F.....	2430
.....	1172, 2545	Schuss, Z.....	2092
Sato, C.J.....	1072	Schuster, G.T.....	1653
Sato, H.....	2291	Schutz, W.....	619, 1107
Sato, S.....	1133	Schwartz, C.W.....	2403
Sato, T.....	2081	Schwartz, H.W.....	2567
Sauer, P.....	950, 1649	Schweitzer, G.....	205, 1252
Saulson, P.R.....	263	Scott, J.F.....	966
Saurer, G.....	2223	Scruby, C.B.....	1245, 1956, 2164
Sauvage, G.....	533, 534	Scruton, C.....	1082
Savage, P.....	1175	Sdouz, G.....	1103
Savkar, S.D.....	2274, 2309	Sebak, A.A.....	814
Sawada, T.....	980	Seebass, A.R.....	1318
Sawanobori, T.....	2069	Seebold, J.G.....	1586
Sayed, A.M.....	757	Seering, W.....	1515
Sayer, R.J.....	1480	Seetharam, S.A.....	126
Saylan, S.....	2215	Seide, P.....	730
Sazawal, V.K.....	95	Seidel, D.A.....	1300, 2470
Scanlan, R.H.....	1479	Seiner, J.M.....	105
Scarton, H.A.....	1925	Seireg, A.A.....	2106
Schafer, D.....	552	Seki, K.....	901
Schamsun, J.T.....	355	Sekiguchi, H.....	341, 1129
Schamel, G.....	2486	.....	2131
Schamell, J.H.....	1676	Sekimoto, S.....	1555
Scharnhorst, T.....	2455	Selberg, B.P.....	1842
Scharrer, J.K.....	1155	Sembi, P.S.....	1953
Schartel, W.A.....	2500	Sen, P.K.....	1408
Scheffey, C.F.....	661	Sen, R.....	1285
Scheuren, J.....	743	Senda, T.....	535
Schibinger, P.....	1997	Seneczko, ed., M.....	1878
Schick, D.....	1369	Senoo, M.....	805
Schiehlen, W.....	1992	Senoo, Y.....	2413
Schmid, D.....	254	Serafetinides, A.A.....	1196
Schmid, I.C.....	1964	Serdar, Jr., L.....	335
Schmidt, D.K.....	2473	Seshadri, R.....	555
Schmied, J.....	221	Seshadri, V.....	268
Schmit, L.A.....	1259	Sessarego, J.P.....	99
Schmitt, B.V.....	1386	Sestieri, A.....	1647
Schmitz, F.H.....	1846	Seth, B.B.....	165
Schnauder, V.....	429, 644	Sethi, V.S.....	1011
Schneider, E.....	2596	Seto, K.....	531
Schneider, G.J.....	1924	Setoguchi, T.....	1348
Schneider, H.G.....	1934	Severin, D.....	1959
Schneider, W.G.....	2317	Severud, L.K.....	42, 946, 2301
Schnobrich, W.C.....	1179, 1922	Seybert, A.F.....	1366, 1599
.....	2298	.....	1639
Schofield, A.N.....	236	Shabana, A.A.....	846, 2182
Scholl, S.....	680	Shah, A.H.....	944, 1002, 1527
Schomer, P.....	953	Shah, S.P.....	142, 1660
Schomer, P.D.....	255, 1312, 1543	Shahin, M.M.A.....	2045
Schosser, R.....	12	Shamroth, S.J.....	2371
Schott, G.A.....	85	Shang, E.-C.....	1368
Schreckenbach, H.....	2031	Shang, P.C.....	2392
Schroedl, M.....	2355	Shankar, N.J.....	568, 2562
Schueler, G.I.....	1995	Shapton, W.....	1512

Shapton, W.R.....	1497	Simic, D.....	1859
Sharan, A.M.....	1025, 1451	Simitzes, G.J.....	419, 915
Shareef, I.....	807	Simmons, B.J.....	1567
Sharif-Bakhtiar, M.....	792	Simmons, H.R.....	67, 653
Sharma, A.M.....	601	Simmons, J.A.....	602
Sharma, C.B.....	756	Simo, J.C.....	545
Sharman, P.W.....	2457	Simon, B.R.....	420
Sharp, B.....	2155	Simon, M.....	2149
Sharp, R.S.....	2047	Simonen, F.A.....	1288, 2300
Shastry, B.P.....	1591	Simonis, J.C.....	1346
Shaw, C.T.....	363	Simpson, A.....	1953, 1989
Shaw, E.A.G.....	2124	Simpson, B.....	1080
Shaw, G.L.....	1567	Simpson, I.C.....	1794
Shaw, S.H.....	171	Sing, R.....	1646
Shaw, S.W.....	2358, 2359	Singh, A.....	544
Shearer, J.L.....	334	Singh, A.V.....	1343
Shell, J.S.....	2384	Singh, B.....	2443
Shepard, G.D.....	1394, 1450	Singh, B.P.....	939
Shepard, M.S.....	2377	Singh, K.....	939
Shepherd, K.P.....	2030	Singh, M.C.....	555
Shepherd, R.....	2501	Singh, M.P.....	104
Shibuya, T.....	1255	Singh, R.....	823, 1393, 1770
Shieh, D.J.....	1290	Singh, V.V.....	1825
Shiga, M.....	46, 765	Singhai, S.....	151
Shih, T.Y.....	72	Sinha, A.....	1265, 1665
Shikida, M.....	1217	Sinha, S.C.....	185
Shimada, T.....	1097	Sinharay, G.C.....	1912
Shimizu, C.....	2291	Sinopoli, A.....	727
Shimogo, T.....	563, 2338	Sireteanu, T.....	2064
Shimura, T.....	1769, 1856	Siskind, D.E.....	1521
Shin, J.K.....	2526	Sisto, F.....	698
Shin, Y.W.....	257, 258	Sivakumaran, K.S.....	81
Shing, Pui-Shum B.....	636	Skaistis, S.J.....	1229
Shing, P.B.....	571	Skelton, R.E.....	147, 2400
Shinke, T.....	316	Skormin, V.....	1630
Shinoda, P.....	2005	Skowronski, J.M.....	649
Shinozuka, M.....	881, 2399	Slater, J.E.....	1693
Shioya, T.....	277	Slater, J.E.....	2230
Shippy, D.J.....	1366	Smalley, A.J.....	653, 1067, 2012
Shirai, M.....	395	Smeby, W.....	1378
Shiraishi, H.....	1894	Smiley, R.G.....	1244, 1690
Shirakashi, M.....	71	Smith, C.A.....	2005
Shivakumar, K.N.....	1195, 1339	Smith, C.C.....	146, 150
Shmutter, S.....	1016	Smith, Jr., C.V.....	2534
Shoji, H.....	1070	Smith, D.R.....	1069
Shoop, S.A.....	351	Smith, G.C.C.....	1494
Shrivastava, S.K.....	2396	Smith, G.M.....	991
Shukla, A.....	156	Smith, J.L.....	690
Shuttleworth, R.....	1057	Smith, J.R.....	208
Shu-hui, J.....	2398	Smith, N.W.....	1240
Si, H.Y.....	113	Smith, P.D.....	326
Siede, P.....	557	Smith, R.A.....	1228
Siegmann, W.L.....	766, 2350	Smith, R.L.....	1247
Siew, A.H.....	2522	Smyly, H.M.....	115
Silcox, R.J.....	1120, 1990	Sniady, P.....	302, 978, 1889
Silverberg, L.M.....	1840, 2608	Snoeys, R.....	773, 821
Silvus, H.S.....	1642	.....	824, 1456, 2121

Snyder, V.W.....	1721	Stallone, M.J.....	219
Sobczyk, K.....	1404	Stanewsky, E.....	1197
Sobek, T.E.....	2337	Stangl, G.....	1817
Socie, D.F.....	129	Stanway, R.....	265
Sock, F.....	2110	Starkey, J.M.....	1697
Soenarko, B.....	1366	Stathopoulos, T.....	471
Sohaney, R.C.....	1685	Stearman, R.O.....	1711
Schoel, E.O.....	2159	Steedman, R.S.....	2345
Soize, C.....	1648	Stein, M.....	2542
Solari, G.....	1520	Stein, P.K.....	1683
Soldatos, K.P.....	1909	Steinhoff, J.S.....	1264
Solecki, J.S.....	1274	Steininger, D.....	1346
Solek, P.....	14	Steininger, D.A.....	2323
Sollman, H.....	460	Stepanishen, P.R.....	342
Solomos, G.P.....	1044	Stephen, R.M.....	240
Soltis, L.A.....	483	Stern, M.....	985, 2352
Som, J.N.....	835	Stevens, J.R.....	1421
Somas, L.....	33	Stevens, J.R.....	2148
Sommerfield, G.A.....	162	Stevens, K.K.....	1392
Sonderegger, H.....	149	Stevens, M.G.....	1521
Sone, A.....	402	Stewart, R.M.....	1726
Song, Ji Oh.....	2448	Sticher, F.....	2192
Song, Zhi-Yung.....	629	Stigmaier, M.....	2437
Soni, A.H.....	2200	Stimpson, G.....	658
Soni, M.L.....	2237, 2488	Stinson, M.R.....	2124
Sonoda, K.....	1348	Stoddard, III, A.T.....	686
Sonsino, C.M.....	381, 2442	Stoffregen, B.....	1960
Sonzogni, V.E.....	668	Stokes, A.N.....	599
Soo, P.....	136	Stone, B.J.....	1321, 1593
Soom, A.....	111	Stone, J.R.....	1835
Soovere, J.....	691, 803, 1899	Stone, T.....	106
Sorella, S.....	425	Stoneking, J.E.....	296
Sortland, B.....	685	Stoneman, S.A.T.....	269
Soucy, Y.....	2581	Storch, J.....	2261
Sousa, A.C.M.....	898	Stover, R.J.....	1874
Southall, R.....	2446	Stradiot, J.....	14
Sozen, M.A.....	189	Strahle, W.C.....	1125
Spagnolo, R.....	330, 1935	Straub, F.K.....	2060
Spann, F.....	1122	Strauss, C.....	1823
Spanos, P.D.....	493	Strauss, J.....	1799
Spanos, P.-T.D.....	1044	Strazisar, A.J.....	2416
Sparks, C.R.....	9	Strijhak, V.....	1207
Spindel, R.C.....	961	Strobel, K.L.....	1779
Spllettstoesser, W.....	1846	Stroeve, A.....	1240
Springer, H.....	207	Strong, J.R.....	2504
Springer, W.T.....	1382	Stronge, W.J.....	277
Spurr, A.....	2299	Strunk, W.D.....	1514
Srinivasan, A.V.....	990, 1570	Stuff, R.....	899
.....	2415, 2517	Stulpinas, B.....	1209
Srinivasan, M.G.....	2388	Stumpf, F.B.....	2199
Srinivasan, R.S.....	586, 2557	Su, H.Y.....	1578
Srinivasan, V.....	2200	Su, J.H.....	387
Staab, G.H.....	637	Su, Qingzu.....	2229
Stachowiak, G.W.....	1445	Su, S.M.....	626
Stagg, M.S.....	1521	Suarez, S.A.....	1473, 2132
Stahl, B.....	993	Suaris, W.....	1660
Staker, C.H.....	1402	Subbiah, R.....	1015

Subrahmanyam, K.B..... 1571, 2538
 Subudhi, M..... 259, 1291, 1918
 Suda, Y..... 677
 Suemasu, H..... 918
 Sueoka, A..... 167
 Suesli, J.L..... 865
 Sugawara, S..... 2546
 Sugimoto, N..... 348, 909
 Sugiyama, M..... 2118
 Sugiyama, Y..... 1176
 Suhara, J..... 928
 Suhir, E..... 2551
 Suhoski, J.E..... 466
 Sukelis, A..... 1209
 Sukelis, A.V..... 1182, 1183
 Sullivan, B.J..... 1266
 Sullivan, J.W..... 172
 Sullivan, P.A..... 1298
 Summer, H..... 392, 1773
 Sun, C.T..... 796, 2135
 Sun, D.C..... 53
 Sun, J..... 521
 Sun, Qing Hong..... 1430
 Sun, Yueming..... 1432, 1730
 Sunakawa, M..... 739
 Sundar, V..... 2562
 Sundararajan, V..... 1331
 Sunden, B..... 2327
 Sunder, R..... 126, 1398
 Sundin, K.G..... 2152
 Sundram, S..... 1057
 Sung, C.K..... 907
 Sung, S.H..... 1537, 1820, 2432
 Sunnersjo, C.S..... 2249
 Suresh, S..... 376
 Surry, D..... 1353
 Susuki, T..... 2019
 Sutela, T..... 424
 Suter, P..... 222
 Suzuki, K..... 96, 318, 402
752, 932, 1344, 1624
 Suzuki, K.-i..... 2433
 Suzuki, S..... 889
 Suzuki, S.-I..... 1913
 Suzuki, T..... 2081
 Swaddiwudhipong, S..... 472
 Swaminadham, M..... 588
 Sweet, L.M..... 247, 1779
 Sy, H.K..... 1539
 Syamal, P.K..... 19, 479, 2364
 Symonds, P.S..... 306, 1663
 Szeliski, Z.L..... 662
 Szoke, D..... 504
 Szrom, D.B..... 2163
 Szymczak, C..... 1887, 1888

Tabarrok, B..... 66, 906, 1036
 Taber, R.C..... 1694
 Tadjbakhsh, I..... 795
 Tadjbakhsh, I.G..... 489, 2195
 Tagawa, Y..... 589
 Tago, Y..... 1220
 Tajima, K..... 2253
 Takagi, M..... 1813
 Takahashi, M..... 597
 Takahashi, R..... 414
 Takahashi, S..... 318, 752
932, 1344
 Takakuda, K..... 1255
 Takallu, M.A..... 786
 Takama, N..... 577
 Takeda, K..... 1765
 Takeda, N..... 1007
 Takizawa, T..... 2535
 Takizawa, Y..... 1255
 Talley, J.Q..... 378
 Tallin, A..... 526
 Talmadge, R.D..... 1413, 1416
 Talreja, R..... 2374
 Tam, C.K.W..... 2571, 2572, 2573
 Tamiya, M..... 1811
 Tamura, A..... 201
 Tamura, H..... 167
 Tan, K.L..... 1539
 Tan, Teong Eng..... 1562
 Tan, Y.S..... 1724
 Tanabe, S..... 1715
 Tanahashi, T..... 980
 Tanaka, H..... 1074
 Tanaka, K..... 299
 Tanaka, M..... 293
 Tanaka, T..... 930, 1217
1566, 2141
 Tanba, A..... 410
 Tang, Daze..... 1689
 Tang, S.H..... 1539
 Tang, Zhiming..... 539
 Tani, J..... 319
 Tanimura, S..... 1006
 Tanna, H.K..... 2571, 2572, 2573
 Tao, D..... 173
 Tappert, F.D..... 960
 Tarics, A.G..... 2243
 Tarrago, J.A..... 1828
 Tarter, J.H..... 2567
 Tassoulas, J.L..... 385, 494
 Tatsuno, T..... 1715
 Tayel, M.A..... 2294, 2295
 Tayel, M.A.H..... 937
 Taylor, J.W..... 684
 Taylor, Jr., L.W..... 515

Taylor, P.A.....	809	Tobocman, W.....	769
Taylor, S.M.....	1557	Tobolka, G.....	397
Taylor, W.....	253, 325	Toki, K.....	1791
.....	523, 525	Toler, D.F.....	843
Tedesco, J.W.....	2293, 2354	Tollbon, B.....	333
Teh, C.E.....	2312	Tolstoy, A.....	2116
Telefono, R.....	226	Tomar, J.S.....	556, 1903
Telesman, J.....	140	Tomaske, W.....	1538
Tembulkar, J.M.....	784, 785	Tominari, N.....	564
Temma, K.....	1881	Tomita, H.T.....	230
Terada, I.....	528	Tomita, Y.....	596
Terauchi, Y.....	791, 864	Tomkins, D.W.....	2578
Terrinoni, L.....	1064	Tomlinson, G.R.....	822, 1441
Tesar, A.....	1622	.....	2149
Tessier, L.P.....	1018	Tonder, K.....	781
Thambiratnam, D.P.....	495, 558	Tondl, A.....	1132
.....	2533	Tong, Pin.....	886
Thawani, P.T.....	2566	Tong, Zhongfang.....	1432
Theocaris, P.S.....	576	.....	1716, 1730
Theocaris, P.S.....	1196	Tonshoff, H.....	1772
Thiede, P.....	1197	Tonshoff, H.K.....	2201
Thiele, R.....	1934	Toridis, T.....	2425
Thien, G.E.....	2003, 2004	Toridis, T.G.....	2215
.....	2016, 2414, 2436	Tornillo, E.J.....	1058
Thigpen, L.....	2189	Torvik, P.J.....	926, 2134
Thinnes, G.L.....	323	Totani, T.....	564
Thiruvengadam, A.P.....	368	Tournerie, B.....	1152
Thiruvenkatachari, V.....	586	Toussi, S.....	189, 2187
Thomas, D.L.....	415, 561	Townley, G.E.....	1710
Thomas, J.....	700	Townsend, J.S.....	551
Thomas, M.....	986	Trankle, T.L.....	1548
Thompson, A.G.....	463	Trankler, H.R.....	1003
Thompson, B.S.....	792, 907	Tran-Cong, T.....	1740
Thompson, J.M.T.....	883	Trethewey, M.W.....	1364, 2386
Thompson, R.B.....	163	Tricamo, S.J.....	860
Thornhill, R.J.....	146, 150	Triebel, I.....	1234
Thorpe, J.....	32	Tripathi, K.K.....	1738
Thrasher, D.F.....	1114	Tripp, H.A.....	866
Thuchiya, K.....	1297	Troeder, C.....	445
Thumler, I.....	1185	Troger, H.....	1821
Thumler, J.....	1369	Tromp, J.H.....	2325
Tichy, J.....	1572	Trubert, M.....	2490
Tidbury, G.H.....	2454	Trudan, D.E.....	2559
Tien, Chieh-Sheng.....	1311	Trundle, C.....	1448
Tietz, W.....	462	Tsai, Jenn-Shing.....	1714
Tiffany, S.H.....	1550	Tsai, T.....	1535
Tigeot, Y.....	1102, 1292	Tsang, Leung.....	2119
Tillman, S.C.....	2553	Tsangarides, M.C.....	2421
Ting, T.C.T.....	347	Tsao, Y.H.....	1040, 1043
Tischler, M.B.....	1833	Tso, W.K.....	1790
Tischler, V.A.....	433	Tsuda, Y.....	167
Titchmarsh, J.M.....	1956	Tsuei, Y.G.....	1963
Tjong, Jimi Sauw-Yoeng.....	874	Tsuei, K.....	2435
.....	1281, 1729	Tsuji, T.....	2536
To, C.W.S.....	87, 789	Tsujikado, K.....	1778
.....	1632, 1633	Tsujiimoto, Y.....	1071
Tobler, W.E.....	2421	Tsujiimura, T.....	1970

Tsujioka, Y.....	2535
Tsukahara, Y.....	2069
Tsung, W.J.....	1830
Tsunoda, H.....	709
Tsurui, A.....	2399
Tsutsui, Y.....	577
Tsutsumi, M.....	2423
Tu, Yan.....	629
Tubis, A.....	575
Tuma, J.J.....	721
Tuncel, O.....	271
Tung, C.....	2248
Turcic, D.A.....	1144, 1145
.....	1146
Turkay, O.S.....	1214
Turnbull, D.H.....	2275
Turner, G.L.....	2014
Turno, L.....	1593
Tustin, W.....	2378
Tuttle, D.G.....	1274
Tygielski, P.J.....	115
Tylikowski, A.....	935
Tzong, T.J.....	21
Tzou, Horn-Sen.....	1464

- U -

Uberall, H.....	1175, 1338
Uchida, T.....	995
Udwadia, F.E.....	431
Ueda, M.....	1192
Ueha, S.....	1923
Uenishi, K.....	91
Ueno, S.....	71
Uhl, T.....	1237
Uibrich, H.....	204
Uldrick, J.P.....	949
Ulm, S.C.....	1004, 1233
Ulrich, A.....	2597
Ulsoy, A.G.....	2524
Umehara, T.....	981
Umezawa, K.....	2081, 2118
Underwood, M.C.P.....	2070
Unger, E.E.....	43
Unger, W.H.....	2460
Unruh, J.F.....	108, 1534, 2588
Upadhyaya, B.R.....	1290
Upasani, S.....	1266
Utku, S.....	2482
Utley, W.A.....	2063
Utsuno, H.....	1566
Utzt, A.....	1109

- V -

Vafae, G.....	1501
Vaicaitis, R.....	1544, 1834
.....	2561, 2565, 1844
Vaidya, N.R.....	41
Vaidya, P.G.....	229
Vakakis, A.F.....	2507
Valenta, P.....	2596
Valerga de Grego, B.....	312
Vallone, C.B.....	1417, 1418
Van Buren, A.L.....	343
Van Campen, D.H.....	202, 2334
Van Dao, Hoang.....	1060
Van de Ponsele, P.....	2121
Van den Braembussche, R.....	2412
Van der Auweraer, H.....	824
van der Burgh, A.H.P... 114,	2258
van der Hijden, J.H.M.T.....	384
.....	388
van der Hoogt, P.J.M.....	2334
Van Herck, P.....	824
Van Horne, J.C.....	1020
Van Hoy, B.W.....	1514
Van Karsen, C.....	633
van Koten, H.....	1089
van Niekerk, B.....	2467
van Santen, J.A.....	2428
Van Woert, R.J.....	1239
Vance, J.M.....	866, 1210
Vandeponsele, P.....	773
Vanderploeg, M.J.....	1814
Vanhoof, H.A.J.....	102
Varadan, V.K.....	101, 387, 1613
Varadan, V.V.....	101, 387, 1613
Vassilev, V.M.....	2227
Vasudevan, N.....	2284
Vaughan, D.K.....	1746
Veglia, B.....	261
Veikos, N.M.....	1058
Veitch, J.G.....	1654
Venkatesan, C.....	688, 1308
Venkateswara Rao, G.....	1591
Venkayya, V.B.....	433, 2483
Venter, K.....	236
Ventres, C.S.....	608
Verdonck, E.....	821
Verma, S.R.....	1011
Verma, V.K.....	1313
Verniere de Irassar, P.L....	297
.....	1161
Vestroni, F.....	665, 728
Viazzi, J.P.....	2552
Vickers, B.H.....	1275
Vickery, B.J.....	1090, 1099
Viegas, J.R.....	2109
Vielsack, P.....	2087

Vigeron, F.R. 1855
 Vigran, T.E. 2108
 Vikopoulos, T. 830
 Villard, B. 2329
 Villaverde, R. 1314
 Ville, J.M. 2341
 Vincent, J.H. 1548
 Vinje, T. 685
 Vinogradov, O.G. 2196, 2532
 Vitaya-Udom, K.P. 345
 Vitelli, R. 1949
 Vogt, J.B. 1227
 Vohr, J.H. 1059
 Vold, H. 1241, 1438, 1442
 1691, 1694, 1718
 Volker, E. 845
 von Flotow, A.H. 2479
 von Glasner, E.C. 1815
 von Hofe, R. 2003, 2004
 Von Nad, J.D. 1524
 von Reth, R.D. 300
 Voorhees, C.R. 1552
 Vorberg, D. 1063
 Vossoughi, J. 1601
 Vu, B.Q. 1958
 Vyas, N.S. 1319

- W -

Waas, G. 1802
 Wachel, J.C. 1069
 Wachter, J. 272
 Wada, B.K. 2496
 Wada, H. 1171
 Wada, S. 52, 709
 1862, 2521
 Wadley, H.N.G. 602, 603
 Wagner, P. 1643
 Wagner, W. 1301
 Wahba, N.N. 764
 Wahyono, A.H. 1592
 Waisanen, P.R. 1838
 Wakiya, S. 71
 Walker, J.C. 2043
 Walker, K.P. 1670
 Wallace, A.A.C. 1081
 Waller, H. 1256, 1961
 Wallo, M.J. 412
 Walowit, J.A. 54, 55
 Walsh, E.K. 984
 Walshe, D.E. 1080, 1082
 Walter, H. 619, 1107
 Walter, P.L. 404
 Walter, R.A. 271
 Walter, T.A. 607
 Walters, W.P. 2356

Walz, J.E. 2487
 Wambsganss, M.W. 1347, 2313
 2314, 2319
 Wampler, C. 2398
 Wang, Bo Ping. 10
 Wang, B.P. 651, 1448, 1699
 1700, 1863, 2194
 Wang, C.Y. 439
 Wang, Fuxing. 2079
 Wang, I-Chih. 1689
 Wang, K.S. 1565, 1596, 2508
 Wang, K.W. 2203
 Wang, Leon Ru-Liang. 1350
 Wang, Maw-Ling. 177, 1998
 Wang, R.T. 1565, 1596, 2508
 Wang, Ton-Lo. 1078
 Wang, X.W. 1724
 Wang, X.Z. 1724
 Wang, Yun Lung. 503
 Wang, Y.F. 1932
 Wang, Y.K. 1918
 Wang, Y.Z. 1596, 2508
 Wang, Y.-Y. 1368
 Wang, Zhifan. 1447
 Wang, Z. 214
 Wang, Z.S. 53
 Wang, Z.W. 817
 Wanner, R. 2223
 Warburton, G.B. 751
 Ward, B.A. 2485
 Ward, H.S. 465
 Ward-Close, C.M. 125
 Ware, A.G. 323, 940, 1631
 Warnock, A.C.C. 2117
 Warren, L.V. 1739
 Warrick, J.C. 896
 Waschl, J.A. 1047
 Wasserman, D.E. 523, 525
 Wasserman, Y. 1335
 Watanabe, T. 426, 528, 2260
 Watcharaumnuay, S. 1603
 Waterman, P.C. 967
 Waters, P.E. 2062, 2419
 Watkins, C.B. 704, 708
 Watkinson, P.S. 155, 337
 Watson, P. 1399
 Watson, P.C. 2224
 Watson, W.R. 90
 Way, D. 2243
 Wayman, J.L. 2238
 Weatherly, G. 1956
 Weaver, D.S. 2305, 2311
 2330, 2331
 Weaver, H.J. 1410, 1428
 1610
 Webster, T. 701
 Weck, M. 196, 1490, 1818

Wedig, W.....	1470, 1974	Wilson, D.A.....	1670
Weeks, G.E.....	2492	Wilson, J.C.....	876
Wegener, R.B.....	2265	Wilson, J.F.....	1156
Wegner, O.....	2385	Wilson, L.L.....	1242
Wei, Fu-Shang.....	2609	Wilson, R.K.....	984
Weiner, D.....	442	Winfree, P.K.....	611
Weinreich, G.....	1371	Winkel, B.V.....	499
Weinreich, R.S.....	1780	Winkler, A.....	992
Weinreich, R.W.....	368	Winklhofer, E.....	2016, 2436
Weisshaar, T.A.....	1332	Winterstein, S.R.....	646, 1669
Welsh, M.C.....	599	Winterton, J.G.....	2078
Welt, F.....	2372	Wirsching, P.H.....	131
Wen, T.....	1360	Wissbrok, H.....	737
Weng, C.I.....	1510	Witek, A.....	461
Werby, M.F.....	968, 2101	Wlezien, R.W.....	2111
Werkle, H.....	474, 1802	Wohle, W.....	2031
Werner, S.....	2425	Wojcik, G.L.....	1746
West, H.H.....	466	Wolak, J.....	68
Westine, P.S.....	356, 1375	Wolde-Tinsae, A.M.....	607
Weston, D.E.....	98	Wolf, B.....	1257
Weston, W.....	215	Wolf, J.P.....	671, 1800, 1801
Wetzel, R.M.....	22	Wolfe, H.F.....	802
Whalen, P.P.....	1940	Wolfer, A.....	1718
Whaley, P.W.....	991, 2520	Wolff, F.H.....	161
Wheeler, W.K.....	2207	Wolffgram, C.E.....	1608
Wheless, T.K.....	434	Wolford, T.C.....	942
Whiston, G.S.....	1890, 1891	Woloch, F.....	1103
White, F.C.....	634	Wong, F.S.....	2086, 2268
White, K.R.....	837	Wong, H.Y.....	1091
White, M.F.....	233	Wong, K.C.....	944, 1002
White, R.G.....	682, 1162, 1163	.....	1527
Whitesell, J.E.....	2524	Wong, W.P.....	327
Whitman, L.....	2033	Wong, W.S.S.....	663
Wicher, J.....	1468	Wood, J.J.....	2502
Widota, A.....	459	Wood, L.A.....	2040
Wiedermann, A.H.....	257, 258	Wood, R.M.....	1836
Wiedner, T.J.....	2377	Woodall, T.D.....	1709
Wiens, G.J.....	185	Woodtli, J.....	1230
Wight, J.K.....	2208	Woodtli-Folprecht,.....	127
Wilby, E.G.....	1306	Woodward, R.P.....	11, 336
Wilby, J.F.....	1306	Woodford, B.V.....	2039
Wilcock, D.F.....	1875	Woowat, A.....	1607
Wildoer, J.....	1187	Wormley, D.N.....	1827
Wilhelmij, P.....	959	Wu, D.W.....	2023, 2024
Wilkerson, J.B.....	274	Wu, H.A.....	1531
Wilks, A.R.....	1654	Wu, James Shih-Shyn.....	422
Will, W.....	548	Wu, S.M.....	2025, 2026
Wille, P.C.....	1934	Wu, S.T.....	478
Willford, M.R.....	1087	Wu, S.Y.....	154, 924, 925
Williams, C.....	1084	Wu, W.F.....	430, 475
Williams, D.....	335	Wu, W.Z.....	1583
Williams, F.W.....	519, 2262	Wu, X.M.....	1509
Williams, III, J.C.....	786	Wu, Zongren.....	2228
Williams, K.L.....	770	Wunderlich, W.....	1799
Williams, R.....	1691	Wyatt, T.A.....	1086, 1093
Williams, R.E.....	2021	Wylde, J.G.....	1879
Willmert, K.D.....	1046	Wynn-Ruffhead, A.....	2456

Wypich, P..... 1866
Wyssmann, H.R..... 718

- X -

Xie, P.L..... 1578
Xing, Zhao..... 1454
Xistris, G.D..... 1029
Xu, Mintao..... 1731
Xu, Yan Chu..... 1430
Xu, Yangshen..... 1688
Xuegang, Yin..... 1606

- Y -

Yabuta, T..... 1970
Yahata, S..... 2422
Yamada, G..... 299, 589, 590
..... 922, 930, 2297
Yamada, H..... 609, 957
Yamada, I..... 1516
Yamada, K..... 61
Yamada, T..... 1180, 2209
Yamaguchi, S..... 1186
Yamaguchi, T..... 1414
Yamaji, T..... 319
Yamakawa, H..... 452
Yamaki, N..... 319
Yamamoto, S..... 2521
Yamamoto, T..... 2, 447
..... 1656, 2010
Yaman, Y..... 1390
Yamane, R..... 578, 596, 597
Yamane, Y..... 348, 909
Yamasaki, T..... 547
Yamashita, A..... 1894
Yanabe, S..... 816
Yanagida, M..... 2113
Yanai, T..... 1880
Yang, C.I..... 2313
Yang, J.C.S..... 1535
Yang, J.N..... 62, 1222
..... 1768, 2528
Yang, Ren-Jye..... 1615
Yang, Shuzi..... 1447
Yang, T.Y..... 488, 758, 1946
..... 2282, 2495, 2577
Yang, Yongxin..... 1743
Yang, Y..... 1744
Yaniv, S.L..... 1930
Yankelevsky, D.Z..... 911
Yano, S..... 181, 780, 979
..... 1208, 1951, 2128, 2185
Yano, T..... 995
Yao, J.T.F..... 189

Yaozhang, Gu..... 2035
Yashiro, H..... 2433
Yasuda, K..... 753
Ye, Kaiyuan..... 2426
Yedavalli, R.K..... 147
Yee, B.G.W..... 62
Yee, K.W..... 2173
Yeh, Yaw-Huei..... 1350
Yehia, N.A.B..... 2377
Yehodian, G.M..... 735
Yellup, J.M..... 1200
Yerges, L.F..... 954
Yi, L.Y..... 394
Yokoi, M..... 535, 1868
Yokose, K..... 1297
Yokoyama, Y..... 1778
Yong, Y..... 2212
Yoo, K.B..... 1175
Yorio, R.N..... 843
Yoshida, A..... 2083
Yoshida, K..... 563, 724
Yoshiki, H..... 577
Yoshimoto, S..... 6, 284
Yoshizawa, M..... 2535
Younes, Y.K..... 988
Young, C.D..... 2018
Young, D.K..... 1364
Young, J.W..... 1704
Young, R.A..... 1806
Youngdahl, C.K..... 258
Yousif, A.E..... 1508
Youtsos, T.G..... 1313
Youwei, Wang..... 2034
Yu, Jingyuan..... 2236
Yu, Junyi..... 2204
Yu, J.C..... 105, 2349
Yuan, J.X..... 1509
Yum, Yung-Ha..... 1623
Yura, J.A..... 288

- Z -

Zach, B..... 1897
Zacharopoulos, A..... 1046
Zahrah, T.F..... 40
Zak, M..... 976
Zalas, J.M..... 1572
Zaman, K.B.M.Q..... 2349
Zang, T.A..... 1232, 1492
Zastrau, B..... 1988
Zdravkovich, M.M..... 1205, 2335
Zeidan, F.Y..... 1065
Zeller, L.D..... 1982
Zeman, K..... 1821
Zemin, Peng..... 1511
Zenda, Y..... 29

Zeuch, W.R.....	439	Zhong, Wan-xie.....	509
Zhang, Lingmi.....	1692	Zhou, Sheng.....	539
Zhang, P.Q.....	1334	Zhu, Guangtian.....	2236
Zhang, Qiang.....	1463	Zhu, Menghua.....	450
Zhang, Q.....	1696	Zhu, W.Q.....	112
Zhang, Yaoqin.....	2220	Ziada, S.....	2307
Zhang, Yi Fei.....	1035	Ziegler, F.....	808
Zhang, Yongxin.....	2079	Zienkiewicz, O.C.....	420
Zhang, Z.C.....	79	Zimmerman, J.....	994
Zhao, Chun-Sheng.....	1703	Zinn, B.T.....	400
Zhao, Lingcheng.....	1440	Zongwu, Hu.....	659
Zheng, Detao.....	2204	Zornig, J.G.....	151
Zheng, Pei-Yi.....	2075	Zu, Deyao.....	2424
Zhong, Liang.....	1325, 1585	Zui, H.....	316
.....	1682	Zukas, J.A.....	2356
Zhong, Qinghui.....	1730	Zukauskas, A.A.....	2315

SUBJECT INDEX

- A -

- Absorbers (materials)
528, 693
- Acceleration measurement
523, 1959
- Accelerographs
832
- Acoustic absorption
90, 528, 1128, 1641, 1933, 1934,
1935, 1936, 2066, 2100, 2123,
2238
- Acoustic emission
602, 603, 640, 839, 1245, 1246,
1616, 1680, 1956, 2164, 2563,
2602
- Acoustic excitation
269, 361, 750, 1421, 1472, 2148
- Acoustic fatigue
741, 802, 803, 918, 1899
- Acoustic filters
397
- Acoustic holography
103, 1478
- Acoustic impedance
1362, 1652, 2066, 2124
- Acoustic insulation
1640, 1931, 2042, 2094
- Acoustic intensity method
958, 1360, 1361, 1420, 2117, 2122
- Acoustic linings
1936
- Acoustic measurement
1188, 1639, 1650
- Acoustic properties
951, 1646, 2066, 2108, 2541, 2603
- Acoustic pulses
927, 959, 1632, 1633, 1770, 1929
- Acoustic resonance
2304, 2307
- Acoustic response
2560
- Acoustic scattering
1191, 1192
- Acoustic signatures
245
- Acoustic techniques
166
- Acoustic tests
838, 2390
- Acoustical insulation
1186
- Acoustical pulses
1853
- Acoustically induced excitation
2478
- Active attenuation
1572
- Active control
243, 1864, 1865, 2466
- Active damping
613, 1209, 1515

Abstract

Numbers: 1-192 193-444 445-652 653-864 865-1055 1056-1263 1264-1496 1497-1756 1757-2002 2003-2199 2200-2406 2407-2618

Volume 17

Issue:	1	2	3	4	5	6	7	8	9	10	11	12
--------	---	---	---	---	---	---	---	---	---	----	----	----

Active flutter control
250, 358, 1550, 1839, 1843, 2473

Active isolation
463

Active noise control
1920

Active vibration control
204, 205, 252, 263, 613, 774,
787, 1115, 1515, 1560, 1561,
1840, 1849, 1897, 2060, 2239,
2365, 2479, 2483, 2484, 2485,
2487, 2583

Actuators
1864, 2484, 2487

Added mass effects
1812

Adhesives
266, 802

Aerodynamic analysis
889

Aerodynamic characteristics
357, 362, 407, 521, 1300, 1301,
1548, 2576

Aerodynamic excitation
1116

Aerodynamic loads
8, 363, 513, 515, 703, 786, 885,
1114, 1117, 1302, 1383, 1475,
1678, 1782, 1836, 1837, 1841,
1842, 1870, 2005, 2247, 2368,
2371, 2415, 2462, 2464, 2472,
2516, 2518, 2519, 2577, 2607

Aerodynamic noise
1370, 2006

Aerodynamic stability
1265

Aeroelasticity
517, 688, 892, 893, 1709, 1870,
1946, 2463

Agricultural machinery
1679

Air blast
109, 350, 351, 352, 353, 354,
732, 1693, 2230

Aircraft
377, 407, 441, 513, 514, 515,
516, 688, 689, 695, 889, 895,
1030, 1111, 1304, 1305, 1542,
1548, 1549, 1550, 1833, 1834,
1837, 1838, 1839, 1843, 1844,
1845, 1965, 1968, 1971, 2231,
2232, 2462, 2471, 2474

Aircraft components
1899, 2460

Aircraft engines
367, 1120

Aircraft equipment response
2056

Aircraft fuselages
1950

Aircraft noise
336, 512, 686, 687, 1118, 1119,
1174, 1306, 1307, 1543, 1544,
1556, 1557, 2461, 2558, 2565

Aircraft propellers
1121

Aircraft tires
2513

Aircraft vibration
1303, 1413

Aircraft windows
31, 32, 33, 35, 36, 2559

Abstract

Numbers: 1-192 193-444 445-652 653-864 865-1055 1056-1263 1264-1496 1497-1756 1757-2002 2003-2199 2200-2406 2407-2618

Volume 17

Issue: 1 2 3 4 5 6 7 8 9 10 11 12

Aircraft wings

250, 1046, 1112, 1113, 1114,
1115, 1116, 1300, 1301, 1302,
1551, 1840, 1841, 1842, 1900,
2057, 2058, 2059, 2233, 2234,
2459, 2463, 2464, 2465, 2466,
2467, 2468, 2469, 2470, 2472,
2598

Airfoils

275, 357, 577, 608, 1117, 1300,
1370, 1571, 1944, 1946, 1965,
2055, 2367, 2368, 2369, 2370,
2371, 2467, 2470, 2576, 2577

Airframes

1668

Airports

686, 953, 1118, 1556

Aitken acceleration method

1741

Algorithms

2157

Alignment

51, 207, 901, 1062, 1324, 1587,
1764, 1766, 1767, 1876, 2007,
2008, 2076, 2160, 2162

Alloys

381

Aluminum

140, 381, 1216, 1217, 1231, 1397,
1667, 1956, 2072, 2143, 2267

Ammunition

255, 344, 1528

Amplification factor method

1079

Amplifiers

1416

Amplitude constraints

2358, 2359

Anisotropy

74, 749, 1165, 2263

Annular plates

586, 588, 745, 1905, 2099, 2286

Antennas

789, 1883

Anthropomorphic dummies

511

Antiresonant analysis

1450

Approximation methods

182, 297, 314, 426, 574, 828,
1161, 1582, 2154, 2191, 2606,
2607

Arches

305, 1166, 1335

Articulated vehicles

506, 1417, 1418, 1817, 1821

Asymmetric excitation

915

Asymmetric vibrations

752

Attitude control equipment

1554

Autocorrelation technique

2394

Automatic control

1774, 1862

Automatic transmission

1074

Automobile engines

2004

Automobile seats

2044

Abstract

Numbers: 1-182 193-444 445-682 683-864 865-1055 1056-1263 1264-1486 1487-1756 1757-2002 2003-2199 2200-2406 2407-2618

Volume 17

Issue: 1 2 3 4 5 6 7 8 9 10 11 12

Automobile steering columns
2590

Automobiles
1107, 1263, 1536, 1537, 1538,
1718, 1818, 1819, 1820, 1865,
2003, 2038, 2042, 2432, 2433,
2435, 2436, 2439, 2442, 2443,
2446, 2457, 2506, 2578, 2597

Automotive engines
874

Autoregressive moving average
models
148

Averaging techniques
522, 633, 847, 1177

Axial excitation
1157, 2262

Axial force
1888

Axisymmetric vibrations
311, 318, 2099, 2287, 2291, 2294,
2295

Axles
2047

- B -

Balancing machines
165, 410

Balancing techniques
4, 411, 412, 413, 414, 842, 1025,
1026, 2157, 2170, 2171, 2172,
2605

Ball bearings
50, 711, 901, 1138, 1580, 1972,
2523

Balls
711

Bands
1583

Barges
2424

Bars
721, 1328, 1329, 1591, 1593, 1884

Base excitation
493, 654, 736, 1202, 1377, 2293

Base isolation
41, 486, 487, 489, 529, 795,
1096, 1127, 1522, 1567, 1707,
2243

Beams
69, 70, 270, 296, 297, 298, 299,
300, 301, 302, 556, 557, 558,
559, 562, 563, 564, 565, 630,
698, 722, 724, 725, 726, 727,
728, 729, 730, 731, 732, 733,
734, 738, 793, 829, 910, 911,
912, 913, 949, 991, 1000, 1160,
1161, 1162, 1163, 1164, 1310,
1330, 1331, 1388, 1425, 1445,
1592, 1594, 1595, 1596, 1597,
1598, 1600, 1601, 1602, 1603,
1642, 1662, 1863, 1885, 1886,
1887, 1888, 1889, 1890, 1891,
1892, 1923, 1957, 2088, 2089,
2090, 2091, 2134, 2239, 2262,
2263, 2264, 2265, 2266, 2267,
2268, 2289, 2355, 2400, 2404,
2533, 2534, 2535, 2536, 2542,
2587

Beam-columns
600, 652, 2217

Bearing races
1345

Bearings
118, 202, 207, 283, 532, 1137,
1139, 1269, 1320, 1874, 2076,
2418

Beat phenomena
2128

Abstract

Numbers: 1-192 193-444 445-662 663-884 885-1065 1066-1263 1264-1496 1497-1766 1767-2002 2003-2196 2200-2406 2407-2618

Volume 17

Issue: 1 2 3 4 5 6 7 8 9 10 11 12

Beck's theory
1251

Bellows
115

Bells
1623, 2102

Belt drives
1018, 2524

Belts
1583

Bending-torsion
725

Berger theory
1172

Bernoulli-Euler method
296, 910, 2263, 2264

Bibliographies
89, 103, 123, 444, 516, 885,
1143, 1262, 1286, 1304, 1478,
1496, 1659, 1753, 1754, 1755,
2145, 2240, 2402

Bifurcation theory
1253, 1979, 1980, 2187, 2358,
2359

Bimodular properties
1614, 1619

Biomechanics
1126

Biot theory
1365, 1484, 1485, 1486, 2146

Bird impact
31, 32, 33, 35, 36, 1574, 2559

Bispectral analysis
1711

Blade loss dynamics
367, 1498

Blade passing frequency
1134

Bladed disks
219, 1570, 1665, 2520

Blades
3, 47, 68, 161, 276, 536, 541,
698, 699, 701, 1301, 1569, 1571,
1871, 2202, 2248

Blast effects
355, 606

Blast loads
82, 331, 333, 344

Blast resistant structures
331, 356, 970, 1375, 1941

Blast response
2110, 2343

Blowers
2413

Boats
248

Bodies of revolution
363, 1910, 2342

Boilers
2323, 2326, 2337

Bolted joints
547, 1327, 2084

Bond graph technique
507, 1751

Bonded structures
802, 1643, 2525

Bones
1408

Booms (equipment)
2056

Abstract

Numbers: 1-192 193-444 445-652 653-864 865-1055 1056-1263 1264-1498 1499-1756 1757-2002 2003-2198 2200-2406 2407-2618

Volume 17

Issue: 1 2 3 4 5 6 7 8 9 10 11 12

Boundary condition effects
190, 710, 926, 1749, 2496

Boundary element technique
491, 671, 726, 1285, 1525, 1526,
1566, 1740

Boundary layer damping
121, 1952

Boundary layer excitation
1944, 2283, 2379, 2380, 2405

Boundary layer
349

Boundary value problems
743, 967, 1255, 1740, 1976, 1977,
1978, 1979, 1980

Braces
63, 65

Brakes (motion arresters)
246, 1497, 2567

Braking effects
2047

Branched systems
1664

Bridges
465, 468, 532, 663, 664, 837,
876, 1079, 1080, 1081, 1282,
1517, 1518, 1659, 1780, 1781,
1782, 1783, 1784, 1889, 2206,
2207, 2214, 2425

Bridge-vehicle interaction
2205, 2426

Buckling
262

Buffeting
2274, 2308, 2309

Building block approach
307, 395, 1704, 2433

Buildings
17, 19, 20, 469, 471, 472, 474,
478, 479, 481, 482, 483, 487,
526, 529, 606, 667, 668, 1087,
1088, 1095, 1283, 1314, 1374,
1519, 1520, 1521, 1522, 1642,
1659, 1786, 2029, 2030, 2031,
2209

Bumpers
1860, 2511

Buses
884, 1299, 1817, 1866, 2444, 2452

Bushings
282

- C -

Cable hangers
697

Cable stayed structures
1156, 1782, 2000, 2207

Cable stiffened structures
2196

Cables
304, 551, 552, 553, 1156, 1590,
1882, 2239, 2255, 2256, 2257,
2531, 2532, 2602

Calibrating
1419, 2387

Cam followers
831

Cantilever beams
736, 737, 922, 1159, 1332, 1333,
1593, 1693, 1743, 1840, 1893,
2261, 2538

Cantilever blades
2057, 2058

Cantilever plates
77, 78, 922, 1620, 1621, 2557

Abstract

Numbers: 1-182 193-444 448-682 683-884 885-1055 1056-1263 1264-1496 1497-1756 1757-2002 2003-2199 2200-2408 2407-2618

Volume 17

Issue: 1 2 3 4 5 6 7 8 9 10 11 12

Caps
1628

Cargo vehicles
2041, 2527

Cargo
504

Cascades
2514, 2515

Case histories
234, 1018, 1024, 1331, 1346,
1359, 1424, 1428, 1464, 1507,
1514, 1528, 1564, 1692, 2012,
2021, 2076, 2163, 2165

Catenaries
2259

Cavitation
57, 58, 360, 1575

Cavities
1002, 1372, 1646, 1647, 2120

Cavity-containing media
2260

Centrifugal compressors
7, 8, 9, 718, 1064, 1065, 1066,
1067, 1068, 1069, 1275, 2012,
2412

Centrifugal forces
51, 52, 199, 453, 1134, 1577

Centrifugal pumps
702, 1023, 1073

Centrifuges
206, 1359

Cepstrum analysis
399

Chatter
234, 1316, 1510, 2022, 2023,
2204, 2254

Chebyshev method
1974

Chebyshev polynomials
2286

Chimneys
1089, 1090, 1091, 1096, 1097,
1098, 1099, 1100, 2032

Circular bars
361, 720

Circular cylinders
71, 303, 567, 2335

Circular plates
311, 312, 314, 385, 583, 587,
746, 932, 1336, 1339, 1616, 1892,
1902, 1904, 2068, 2287, 2291,
2554, 2555

Circular rings
1345

Circular saws
1776, 2203

Circular shells
2297

Clearance effects
1580, 2526, 2529

Clutches
1020

Coherence function technique
1712, 2386

Collapse
2362

Collision research (ships)
1859, 2052, 2448, 2450, 2451,
2452, 2453, 2454, 2455, 2456,
2457, 2054

Collocation method
315, 1902

Abstract

Numbers: 1-182 183-444 445-882 883-984 985-1055 1056-1263 1264-1486 1487-1756 1757-2002 2003-2198 2200-2406 2407-2618

Volume 17

Issue: 1 2 3 4 5 6 7 8 9 10 11 12

Columns
72, 262, 569, 739, 1251, 1604,
1605, 2092, 2212, 2278, 2279

Combination resonance
2322

Combustion engines
455

Combustion noise
455, 2417

Commercial transportation
1814

Compacting
1496

Compaction equipment
2584

Complex modes
1394, 1424, 1430

Complex structures
1710

Component mode analysis
1855, 2490

Component mode synthesis
10, 152, 153, 389, 630, 816, 817,
917, 1164, 1443, 1444, 1994,
2432, 2489, 2592

Composite beams
264

Composite materials
623, 1242, 1401, 1473, 1484,
1668, 1723, 1899, 2132, 2135,
2374, 2375, 2491, 2544

Composite plates
2281

Composite structures
637, 802, 803, 933, 1165, 1614,
1967, 2097, 2143, 2285, 2288

Compressive strength
1130, 1131

Compressor blades
269, 539

Compressors
653, 1763

Computer aided techniques
12, 410, 429, 462, 625, 644, 800,
866, 892, 1026, 1083, 1248, 1553,
1752, 1967, 2007, 2161, 2197,
2198, 2446, 2473

Computer graphics
1609

Computer programs
31, 35, 36, 179, 192, 194, 202,
217, 259, 324, 352, 357, 435,
436, 437, 438, 439, 440, 445,
486, 508, 519, 521, 569, 592,
593, 594, 595, 652, 738, 842,
861, 862, 863, 903, 940, 942,
943, 1047, 1048, 1049, 1050,
1051, 1052, 1053, 1075, 1076,
1089, 1103, 1110, 1116, 1122,
1152, 1260, 1261, 1262, 1263,
1311, 1313, 1431, 1462, 1494,
1495, 1508, 1579, 1590, 1623,
1625, 1632, 1633, 1702, 1750,
1767, 1819, 1829, 1994, 2000,
2001, 2002, 2034, 2045, 2046,
2107, 2177, 2196, 2199, 2200,
2208, 2214, 2219, 2222, 2228,
2255, 2257, 2343, 2365, 2393,
2403, 2404, 2405, 2406, 2425,
2440, 2553, 2585, 2601, 2615

Computer storage devices
1455, 1687, 2612

Computerized simulation
1770, 1824, 2421, 2523

Concentric shells
755

Concentric structures
805, 1908, 2218, 2296, 2299, 2342

Abstract

Numbers: 1-192 193-444 445-852 853-984 985-1085 1086-1263 1264-1496 1497-1756 1757-2002 2003-2198 2200-2406 2407-2618

Volume 17

Issue: 1 2 3 4 5 6 7 8 9 10 11 12

Concrete
142, 345, 496, 1247, 1529, 1530,
1660, 2223, 2354, 2423

Condensation method
849, 1025, 1042

Condensers
2320

Conformal mapping
1610, 1742

Conical shells
590, 1344

Constitutive equations
624, 777, 1660, 1670, 2186

Constrained structures
733, 846, 2398

Construction equipment
2063, 2427

Construction industry
1540

Contact pressure
2245

Contact vibration
111, 971, 1138, 2360

Containers
82

Continuous parameter method
177, 432, 859, 1738, 2396, 2608,
2610

Continuous systems
972, 978

Continuum mechanics
307, 386, 480, 666, 796, 2184

Control equipment
38, 147, 200, 1181

Control simulation
891

Conveyors
1778, 2028

Cooling systems
1637, 2003, 2004, 2414, 2601

Cooling towers
488, 1095, 1523, 2008, 2078,
2210, 2212, 2298

Coriolis forces
453

Cornering effects
1827

Correlation technique
648, 1447, 1448

Corrosion fatigue
129, 380, 549, 1645, 1879

Coulomb damping
990

Coulomb friction
334, 368, 369, 370, 795, 1202,
1265, 1600, 1607, 1665, 1780,
2251

Coupled response
272, 1234, 1806, 2534, 2536

Coupled systems
783, 784, 785

Couplings
1, 904, 905, 1878

Covariance function
1040

Crack detection
161, 840, 1247, 1500

Abstract

Numbers: 1-182 183-444 445-662 663-884 885-1065 1066-1283 1284-1486 1487-1756 1757-2002 2003-2186 2200-2406 2407-2618

Volume 17

Issue: 1 2 3 4 5 6 7 8 9 10 11 12

Crack propagation
62, 126, 128, 139, 140, 289, 373,
374, 375, 376, 576, 617, 620,
804, 996, 1196, 1217, 1222, 1223,
1224, 1225, 1226, 1228, 1230,
1397, 1407, 1660, 1670, 1996,
2140, 2142, 2231, 2298, 2377,
2403, 2441, 2528, 2585, 2586

Cracked media
220, 221, 384, 388, 997, 998,
1255, 1408, 1625, 1629, 1671,
1674, 1958, 2091, 2093, 2102,
2103, 2355

Cranes (hoists)
660, 2424

Cranes
15, 16

Crankshafts
1272, 2013

Crash research (aircraft)
511, 890, 1110

Crashworthiness
1957, 2448, 2454, 2458

Critical damping
1391

Critical flow velocity
2316, 2333

Critical speeds
44, 66, 447, 452, 653, 866, 1270,
1271, 1759

Curve fitting
390, 391, 706, 1432, 1433, 1434,
1435, 2181

Curved beams
560, 735, 820, 2537

Curved pipes
759, 760

Curved plates
2556

Cutting
462, 872, 2024, 2025, 2026, 2204

Cyclic loading
65, 142, 237, 600, 928, 977, 988,
1170, 1603, 1609, 2208

Cylinders
304, 566, 568, 645, 786, 805,
812, 914, 982, 1165, 1178, 1541,
1807, 1811, 1895, 1896, 1926,
2218, 2269, 2270, 2271, 2272,
2273, 2274, 2275, 2276, 2277

Cylindrical cavities
113

Cylindrical shells
319, 320, 589, 590, 591, 755,
756, 757, 930, 935, 944, 1130,
1174, 1624, 1625, 1627, 1648,
1907, 1908, 1911, 1912, 2103,
2226, 2293, 2294, 2295, 2296,
2297, 2299, 2561

- D -

Damage prediction
96, 2230, 2324, 2447, 2455, 2586

Damage
189

Damped modes
1466, 1885

Damped structures
601, 826, 850, 1259, 1260, 1382,
1501, 1733, 1759, 1898, 2134,
2408, 2580

Dampers
118, 366, 369, 450, 611, 794,
992, 1119, 1215, 1562, 1665,
1953, 2032

Abstract

Numbers: 1-182 183-444 445-652 653-864 865-1066 1067-1283 1284-1486 1487-1756 1757-2002 2003-2189 2200-2408 2407-2618

Volume 17

Issue: 1 2 3 4 5 6 7 8 9 10 11 12

Damping characteristics
2301

Damping coefficients
237, 279, 282, 290, 291, 292,
293, 323, 365, 460, 461, 531,
653, 685, 718, 837, 940, 945,
1073, 1092, 1132, 1139, 1148,
1214, 1321, 1327, 1376, 1390,
1512, 1528, 1576, 1578, 1631,
1636, 1743, 1825, 1875, 1955,
2027, 2074, 2075, 2132, 2133,
2137, 2139, 2325, 2328, 2373,
2487, 2532, 2544, 2582, 2592

Damping effects
391, 499, 504, 554, 782, 793,
797, 883, 972, 1356, 1358, 1394,
1488, 1511, 2136, 2333, 2500,
2583

Damping materials
2423

Damping properties
121

Damping synthesis
2237, 2488

Damping
719, 737, 798, 946, 1212

Dams
239, 240, 496, 497, 795, 1287,
1529, 1530, 1659, 2036, 2220,
2221

Dashpots
1388

Data dependent systems
1497

Data processing
863, 1292, 1413, 1437, 1448,
1453, 1457, 1650, 1708, 2595

Data recorders
1413, 2450, 2593, 2594

Derailment
247

Design sensitivity analysis
1489, 1749

Design techniques
271, 568, 683, 741, 819, 907,
986, 1004, 1091, 1126, 1136,
1166, 1282, 1318, 1374, 1547,
1565, 1748, 1786, 1793, 1796,
1831, 1915, 2002, 2004, 2046,
2393, 2432, 2442, 2445, 2446,
2448, 2451, 2457, 2466, 2526,
2603, 2612, 2614

Detectors
158

Diagnostic instrumentation
162

Diagnostic techniques
161, 163, 164, 408, 412, 839,
840, 841, 1016, 1019, 1020, 1021,
1022, 1023, 1024, 1480, 1481,
1508, 1644, 1724, 1729, 1972,
1973, 2157, 2158, 2159, 2160,
2161, 2162, 2163, 2164, 2165,
2166, 2167, 2169, 2600, 2601

Diesel engines
395, 2017, 2018, 2019, 2417,
2418, 2419, 2422, 2436

Differential equations
1981

Digital filters
851

Digital simulation
334

Digital techniques
1452, 2167

Dimensional analysis
1445

Abstract

Numbers: 1-192 193-444 445-652 653-864 865-1055 1056-1263 1264-1488 1489-1756 1757-2002 2003-2199 2200-2406 2407-2618

Volume 17

Issue: 1 2 3 4 5 6 7 8 9 10 11 12

Direct integration technique
 179

Discontinuity-containing media
 101, 581, 857, 928, 2555

Discrete Fourier transform
 5, 1961

Disks
 3, 47, 231, 536, 542, 584, 585,
 682, 988, 1340, 1341, 1502, 1569,
 1868, 2098, 2202

Displacement measurement
 2381, 2382

Domes
 1651

Doors
 331, 1941

Doubly asymptotic approximation
 1942

Drag coefficients
 985, 1590, 1811, 1812

Drilling platforms
 243, 942, 1294, 1295, 1296, 1535,
 1806

Drills
 1512, 1775

Driveline vibrations
 929, 1016, 2421

Drives
 392

Ducts
 90, 91, 92, 93, 94, 95, 329, 596,
 597, 598, 599, 947, 1351, 1639,
 1920, 1921, 2108, 2109, 2340,
 2341, 2342

Duncan method
 989

Dykes
 236

Dynamic absorbers
 531, 2508

Dynamic buckling
 65, 580, 754, 919, 1628, 1957,
 2087, 2334

Dynamic condensation method
 1465, 2614

Dynamic data system technique
 1509, 2025, 2026

Dynamic force analysis
 2011

Dynamic modeling
 1716, 1751

Dynamic plasticity
 174, 308

Dynamic response
 190, 233, 2151

Dynamic stability
 16, 419, 935, 1252, 1298, 1329,
 1385, 1591, 2195, 2524

Dynamic stiffness
 494, 1267, 1458, 2256

Dynamic stress concentration
 1007

Dynamic structural analysis
 183, 402, 437, 641, 911, 1035

Dynamic systems
 1042

Dynamic tests
 85, 241, 1092, 1131, 1242, 1797,
 1860, 1970, 2035, 2391

Dynamic vibration absorption
 (equipment)
 692, 1382

Abstract

Numbers: 1-192 193-444 445-682 683-864 865-1055 1056-1263 1264-1496 1497-1756 1757-2002 2003-2196 2200-2406 2407-2618

Volume 17

Issue: 1 2 3 4 5 6 7 8 9 10 11 12

- E -

Earth handling equipment
673

Earthquake damage
96, 477, 969

Earthquake excitation
40

Earthquake prediction
1945

Earthquake resistant structures
40, 1235

Earthquake response
72, 188, 236, 475, 476, 832, 876,
1464, 2036

Earthquake simulation
1993

Earthquakes
104, 108, 1479

Eccentricity
1137, 1340, 1587, 1790, 1873,
2364

Eddy current probes
408, 2174

Eigenvalue problems
3, 5, 180, 310, 416, 417, 444,
642, 1436, 1463, 1466, 1487,
1489, 1491, 1501, 1504, 1688,
1696, 1733, 1736, 2183, 2397,
2609, 2610, 2611

Elastic foundations
1903, 2029, 2213

Elastic media
721, 976, 1409, 1976

Elastic plastic properties
306, 383, 762, 911, 928, 1663,
2087

Elastic properties
313, 385, 386, 805, 806, 1338,
1581, 1602, 1689, 2284

Elastic restraints
751, 1601, 2264

Elastic supports
697, 746, 754, 1161, 2547

Elastic systems
419, 1144, 1145, 1146

Elastic waves
144, 145, 384, 387, 388, 772,
808, 810, 812, 1001, 1002, 1193,
1194, 1328, 1675, 1722, 1906,
1907, 1927

Elasticity theory
760

Elastodynamic response
1036, 1978

Elastohydrodynamic properties
48, 49, 831

Elastomeric bearings
545, 664, 900, 1127

Elastomeric dampers
929, 1096, 1133

Elastomers
529, 1123, 1215, 1317, 1878, 1955

Electric raceways
335

Electromagnetic bearings
1140

Electromagnetic excitation
204, 1894, 2407

Electromagnetic properties
205, 840, 1209, 1320

Electromagnetic shakers
1182, 1183

Abstract

Numbers: 1-182 183-444 445-852 853-884 885-1055 1056-1263 1264-1486 1487-1756 1757-2082 2083-2198 2200-2486 2487-2818

Volume 17

Issue: 1 2 3 4 5 6 7 8 9 10 11 12

Electromagnetic waves 810, 814	Equipment-structure interaction 86, 779, 974, 1358
Electronic instrumentation 897, 1424	Equivalent continuum method 2282, 2481
Elevators 1464	Equivalent linearization method 847
Enclosures 1372, 1935, 2563	Error analysis 280, 636, 1440, 1555, 1639, 2386
Energy absorption 40, 257, 262, 264, 896, 1130, 1861, 2457, 2458, 2525	Euler beams 723
Energy dissipation 520, 1388	Euler equation 1492
Energy transmission 733	Exact methods 310, 314, 426, 993, 1624, 2261
Engine cylinder blocks 2014	Exhaust noise 2570
Engine mounts 2509, 2510	Exhaust systems 2566
Engine noise 1896, 2015, 2016, 2417, 2420, 2435, 2437, 2601	Expandable structures 2492
Engines 842	Experimental data 8, 61, 217, 242, 336, 360, 537, 690, 803, 818, 832, 866, 876, 898, 1082, 1107, 1110, 1131, 1146, 1457, 1602, 1604, 1620, 1631, 1649, 1650, 1652, 1666, 1688, 1701, 1705, 1807, 2271, 2272, 2276, 2310, 2315, 2317, 2319, 2325, 2453, 2470, 2529, 2562
Environment simulation 1122	Experimental modal analysis 392, 393, 394, 625, 797, 823, 824, 825, 1051, 1111, 1240, 1272, 1284, 1303, 1319, 1334, 1361, 1364, 1374, 1391, 1402, 1410, 1411, 1412, 1413, 1414, 1416, 1419, 1420, 1421, 1422, 1423, 1428, 1429, 1430, 1431, 1432, 1439, 1462, 1473, 1480, 1497, (continued)
Environmental effects 505, 1136	
Equations of motion 80, 81, 422, 427, 688, 892, 1018, 1033, 1034, 1145, 1302, 1584, 1985, 2189, 2398	
Equipment mounts 256	
Equipment response 108, 779	

Abstract

Numbers: 1-192 193-444 445-682 683-864 865-1085 1086-1283 1284-1486 1487-1786 1787-2002 2003-2186 2200-2406 2407-2618

Volume 17

Issue: 1 2 3 4 5 6 7 8 9 10 11 12

**Experimental modal analysis
(cont'd)**

1508, 1514, 1522, 1523, 1528,
1530, 1533, 1536, 1541, 1552,
1568, 1569, 1583, 1682, 1683,
1684, 1685, 1686, 1687, 1688,
1689, 1690, 1691, 1692, 1693,
1694, 1695, 1696, 1697, 1698,
1723, 1729, 1753, 2148, 2150,
2590

Explosion effects
355, 1200, 2356

Exponential window method
1694

External damping
202, 1251

- F -

Failure analysis

382, 617, 646, 1017, 1018, 1024,
2077, 2079

Failure detection

637, 640, 841, 1245, 1500, 1535,
1723

Fan blades

277, 2514, 2515, 2516

Fan noise

11, 336, 656

Fans

197, 229, 1004, 1134, 1233, 1273,
1274, 1480, 1990, 2003, 2004,
2078, 2414, 2415, 2416

Fast Fourier transform

342, 423, 425, 1414, 1454, 1459,
1473, 1483, 1885, 2373, 2380

Fasteners

64, 2250, 2528

Fatigue life

22, 27, 62, 127, 128, 129, 130,
131, 132, 133, 134, 135, 136,
137, 138, 139, 140, 141, 288,
372, 373, 374, 375, 376, 377,
378, 379, 546, 550, 617, 618,
619, 662, 700, 713, 714, 715,
750, 800, 801, 843, 868, 869,
880, 928, 993, 994, 1078, 1093,
1094, 1100, 1135, 1163, 1216,
1217, 1218, 1219, 1220, 1221,
1222, 1224, 1225, 1226, 1227,
1228, 1229, 1246, 1294, 1319,
1326, 1346, 1396, 1397, 1399,
1400, 1402, 1404, 1405, 1406,
1570, 1603, 1625, 1645, 1667,
1668, 1669, 1768, 1775, 1866,
1877, 1882, 1956, 2059, 2072,
2084, 2143, 2144, 2231, 2232,
2252, 2374, 2375, 2376, 2440,
2441, 2442, 2444, 2460, 2528,
2585, 2586, 2615

Fatigue tests

61, 123, 124, 125, 126, 289, 380,
381, 441, 547, 548, 799, 991,
995, 1107, 1180, 1230, 1231,
1395, 1398, 1401, 1403, 1521,
1569, 1780, 1850, 1879, 1967,
2083, 2140, 2141, 2443

Fault detection

2157

Feedback control

2495

Fiber composites

138, 264, 631, 741, 1007, 1050,
1365, 1602, 1658, 2156, 2373,
2540

Finite difference technique

898, 1571, 1578, 1618, 1745,
1944, 2351, 2538, 2553

Finite element technique

21, 35, 47, 74, 153, 173, 178,
194, 220, 226, 387, 418, 422,
428, 437, 453, 454, 461, 509,
(continued)

Abstract

Numbers: 1-192 183-444 446-882 883-884 885-1055 1056-1283 1284-1498 1497-1788 1787-2002 2003-2198 2200-2408 2407-2618

Volume 17

Issue: 1 2 3 4 5 6 7 8 9 10 11 12

Finite element technique (cont'd)

541, 545, 573, 579, 656, 660,
675, 707, 714, 723, 729, 816,
821, 854, 876, 879, 886, 889,
924, 925, 939, 941, 999, 1032,
1072, 1105, 1110, 1144, 1145,
1184, 1195, 1261, 1274, 1276,
1277, 1337, 1422, 1440, 1464,
1490, 1509, 1525, 1527, 1531,
1536, 1537, 1549, 1568, 1583,
1591, 1599, 1600, 1606, 1615,
1618, 1623, 1646, 1658, 1661,
1693, 1705, 1710, 1714, 1731,
1732, 1740, 1791, 1806, 1819,
1820, 1853, 1866, 1874, 1887,
1896, 1919, 1947, 1952, 1982,
1990, 2000, 2001, 2036, 2046,
2069, 2086, 2093, 2104, 2121,
2134, 2135, 2190, 2205, 2215,
2216, 2217, 2219, 2230, 2259,
2281, 2282, 2285, 2305, 2361,
2377, 2403, 2404, 2406, 2449,
2495, 2537, 2544, 2550, 2554,
2603, 2611, 31, 36, 569, 698,
725, 1026, 1343, 1530, 1750,
2400, 2455, 2612

Finite segment method
1664, 2257, 2494

Flexible bearings
1499

Flexible couplings
1141

Flexible foundations
214, 696

Flexible rotors
4, 5, 201, 202, 203, 205, 209,
213, 215, 219, 411, 413, 451,
1061, 1141, 1268, 1269, 1498

Flexible shafts
3, 1482

Flexural vibration

70, 212, 445, 449, 460, 539, 560,
565, 682, 726, 727, 743, 745,
917, 920, 921, 1113, 1160, 1172,
1345, 1601, 1923, 2090, 2201,
2261, 2262, 2263, 2288, 2534,
2545, 2555

Flexural waves
733, 829, 1169

Flight simulation
125

Flight test data
1013

Flight tests
300

Floating ice
1613

Floating structures
510, 1919

Floors
480, 600, 601, 763, 1289, 2344

Floquet theory
1252

Flow-induced excitation
2307, 2325, 2328, 2329, 2367

Fluid elastic instability
2310

Fluid film bearings
57, 58

Fluid inertia forces
1322, 1577, 2521

Fluidelastic instability
2313, 2318, 2325, 2330, 2331,
2332, 2333

Fluids
622

Abstract

Numbers: 1-192 193-444 445-652 653-864 865-1055 1056-1263 1264-1486 1487-1756 1757-2002 2003-2199 2200-2406 2407-2618

Volume 17

Issue: 1 2 3 4 5 6 7 8 9 10 11 12

Fluid-filled containers

199, 218, 257, 258, 298, 319,
328, 364, 782, 867, 937, 938,
949, 981, 984, 1176, 1635, 1732,
2294, 2295, 2296, 2539

Fluid-filled media

985, 2189, 2219

Fluid-film bearings

213, 215, 279, 281, 1575, 1577,
1578, 2074, 2075, 2410

Fluid-induced excitation

7, 9, 67, 71, 88, 115, 116, 224,
268, 293, 294, 500, 566, 577,
599, 775, 908, 936, 951, 968,
980, 983, 1059, 1064, 1070, 1071,
1072, 1090, 1102, 1114, 1150,
1151, 1153, 1154, 1155, 1178,
1188, 1210, 1292, 1338, 1348,
1487, 1651, 1895, 1908, 1917,
1946, 2098, 2224, 2225, 2226,
2247, 2253, 2269, 2270, 2271,
2272, 2273, 2274, 2275, 2276,
2277, 2283, 2292, 2299, 2303,
2304, 2305, 2306, 2308, 2309,
2310, 2311, 2312, 2313, 2314,
2315, 2316, 2317, 2318, 2319,
2320, 2321, 2322, 2323, 2324,
2326, 2327, 2330, 2331, 2332,
2333, 2334, 2335, 2336, 2337,
2338, 2342, 2346, 2357, 2368,
2369, 2379, 2381, 2409, 2411,
2416, 2459, 2465, 2471, 2472,
2530, 2547

Fluid-induced vibration

1776, 2339

Fluid-inertia forces

1582

Fluid-structure interaction

23, 25, 122, 273, 298, 439, 759,
882, 981, 982, 1049, 1495, 1932,
1938, 1939, 1942, 2227, 2361,
2366

Flutter

222, 357, 536, 539, 657, 689,
975, 1013, 1082, 1112, 1113,
1115, 1383, 1547, 1549, 1711,
1782, 1838, 1883, 1965, 2057,
2058, 2093, 2104, 2292, 2334,
2409, 2467, 2468, 2469, 2470,
2471, 2472, 2474, 2516, 2517,
2557, 2575, 2577, 2598, 2599,
2609

Foams

1365

Foil bearings

54, 55

Follower forces

559, 1251

Footings

494

Force balance method

2135

Force coefficients

13, 268, 2095

Force measurement

294, 768, 1238, 1417, 1418, 1456,
1678, 2152, 2312

Force prediction

1715, 2299, 2587

Forced vibration

4, 216, 585, 1439, 1494, 1594,
1600, 2068, 2520, 2550, 2580

Forcing function

643, 875, 1018, 2379

Forging machinery

13, 253

Foundations

20, 236, 664, 670, 1004, 1101,
1233, 1525, 2076, 2217

Abstract

Numbers: 1-182 183-444 445-882 883-884 885-1085 1086-1283 1284-1488 1489-1786 1787-2002 2003-2189 2200-2408 2409-2618

Volume 17

Issue: 1 2 3 4 5 6 7 8 9 10 11 12

Four bar mechanisms
861, 1145, 1146, 2195

Fourier analysis
1232

Fourier transformation
720

Fracture properties
28, 156, 607, 886, 999, 1288,
1668, 1670, 1996, 2145, 2355

Framed structures
761, 762, 1608, 1609, 1644

Frames
18, 63, 65, 306, 307, 473, 481,
484, 570, 571, 572, 652, 915,
916, 1334, 1606, 1607, 2000, 2404

Fredholm equation
2549

Free vibration
73, 428

Freight cars
503, 1784, 2175

Frequency analysis
738

Frequency analyzers
1677, 1681

Frequency constraints
433, 912, 1046

Frequency dependent parameters
985

Frequency domain method
38, 391, 467, 501, 836, 975,
1043, 1106, 1214, 1296, 1334,
1434, 1437, 1453, 1467, 1520,
1630, 1695, 1833, 1849, 1900,
1937, 2050, 2418, 2473, 2490,
2574, 2575

Frequency response functions
146, 390, 423, 633, 827, 1010,
1241, 1414, 1426, 1433, 1712,
1015, 1442, 1452, 1648, 1694,
1700, 1701, 1707, 1714, 1715,
1718, 2386

Frequency response
398, 651, 1439, 1702, 2383

Frequency spectra
2384

Fretting corrosion
50, 549, 1874

Fretting fatigue
143

Friction
45, 111, 807

Fuel tanks
2460

Fundamental frequency
1904, 2089, 2534, 2543, 2096

Fundamental modes
635, 2089

- G -

Galerkin method
311, 472, 744, 745, 1333, 1738

Galloping
2258, 2259, 2269, 2372, 2531

Gas bearings
6, 53, 54, 55, 56, 284, 704, 708

Gas turbine engines
1666

Gas turbines
164, 216, 615, 843, 844, 1020

Abstract

Numbers: 1-182 183-444 445-652 653-864 865-1055 1056-1263 1264-1496 1497-1756 1757-2002 2003-2186 2200-2406 2407-2618

Volume 17

Issue: 1 2 3 4 5 6 7 8 9 10 11 12

Gases
368

Gear boxes
287, 1873, 2080, 2163, 2422

Gear noise
1325, 1585

Gear teeth
285, 546, 2083

Gears
228, 286, 443, 861, 903, 1584,
1877, 2077, 2078, 2079, 2080,
2168, 2235

Gear-induced vibrations
1016

Generators
395, 1019, 1764

Geometric effects
8, 292, 316, 1571, 1615, 1620,
1649, 2022, 2328, 2516, 2603

Geometric imperfection effects
76, 228, 285, 913, 1617, 2249

Girders
1518, 1967

Glass reinforced plastics
1745, 1860, 2373

Global fitting method
1433, 1884

Global identification technique
1702

Gradient methods
2464

Grain silos
1387, 1524

Graphic methods
1553, 1752, 2473

Gravity effects
167

Green function
342, 585, 1800, 1987, 2153, 2549

Grids (beam grids)
307, 2239

Ground effect machines
1109, 1298

Ground motion
17, 104, 370, 452, 479, 1287,
1526, 1790, 1945

Ground shock
2033

Ground vehicles
245, 463, 504, 507, 676, 788,
862, 1106, 1374, 1814, 1815,
1816, 1857, 1968, 2039, 2040,
2041, 2043, 2044, 2045, 2050,
2051, 2064, 2430, 2431, 2440,
2441, 2449, 2458, 2509

Ground vibration
350, 351, 352, 353, 354, 1055

Guardrails
2456

Guyed structures
1808

Gyroelastic properties
2493

Gyroscopes
199, 364, 798

- H -

Hamiltonian principle
81, 699, 924, 2191

Hand tools
523, 524, 525

Abstract

Numbers: 1-192 193-444 445-652 653-864 865-1055 1056-1263 1264-1486 1487-1756 1757-2002 2003-2198 2200-2408 2407-2618

Volume 17

Issue: 1 2 3 4 5 6 7 8 9 10 11 12

Harmonic analysis
443, 852, 1386, 1949

Harmonic balance method
154, 1253, 1894

Harmonic excitation
171, 182, 414, 493, 562, 721,
729, 753, 782, 827, 850, 1061,
1287, 1319, 1384, 1524, 1919,
2207, 2358, 2359, 2362, 2364,
2546

Harmonic functions
1740

Harmonic response
1056

Harmonic waves
622, 811

Head (anatomy)
1311

Heat exchangers
89, 500, 880, 1331, 1346, 1636,
1917, 2292, 2308, 2310, 2311,
2313, 2315, 2316, 2317, 2318,
2319, 2324, 2330, 2331, 2336

Heat generation
977

Heaving
2428, 2429

Helical gears
715, 2081

Helical springs
533, 534, 2069

Helicopter noise
894, 1543, 1545, 1546, 1848,
1851, 1852

Helicopter rotors
517, 1051, 1846, 2005

Helicopter vibrations
893, 1561, 1849, 1051

Helicopters
30, 232, 249, 274, 275, 300, 441,
516, 537, 540, 891, 892, 1308,
1547, 1573, 1760, 1847, 1850,
1870, 1877, 2060, 2073, 2519

Helmholtz integral method
769, 1366

Helmholtz resonators
1647

Hertzian contact
2406

High speed transportation systems
1783

Hilbert transforms
629, 1441, 1706, 2149

Hobbing
873

Holes
2124

Hole-containing media
226, 951, 1007, 1397, 1628

Holographic techniques
538, 588, 632, 1337, 1676, 1724,
2019, 2155, 2514, 2596

Honeycomb structures
1149, 1544, 1845

Hopkinson bar technique
1242

Horns (sound generators)
1128

Human factors engineering
1085

Human hand
523, 524, 525

Abstract

Numbers: 1-182 183-444 445-882 883-884 885-1085 1086-1283 1284-1486 1487-1786 1787-2002 2003-2196 2200-2406 2407-2618

Volume 17

Issue: 1 2 3 4 5 6 7 8 9 10 11 12

Human response

253, 254, 255, 522, 523, 524,
525, 526, 527, 1312, 1556, 1557,
1558, 1857, 1858, 1859, 2061,
2062, 2063, 2502, 2503, 2504,
2505, 2506

Hunting motion

678, 1830

Hybrid simulation

21

Hydraulic dampers

614

Hydraulic equipment

1229

Hydraulic servomechanisms

334

Hydraulic systems

954, 2509

Hydrodynamic bearings

1015

Hydrodynamic excitation

239, 303, 510, 983, 1807, 1808,
1811, 1812, 1915

Hydrodynamic lubrication

781, 2522

Hydrodynamic response

298, 2354

Hydroelectric power plants

498

Hydrostatic bearings

211

Hysteretic damping

69, 187, 513, 1065, 1922, 2276,
2532

Immittance identification

1816

Impact dampers

2138

Impact excitation

110, 172, 582, 995, 1184, 1237,
1341, 1363, 1660, 2090

Impact force

146, 1006

Impact hammer tests

1421, 1422, 1423, 1473, 2148,
2229

Impact noise

255, 1312

Impact pairs

2300

Impact response

26, 32, 34, 277, 324, 593, 594,
595, 943, 1000, 1158, 1195, 1196,
1328, 1339, 1518, 1589, 1658,
1661, 1815, 1890, 1891, 2091,
2223, 2265, 2267, 2278, 2539,
2559

Impact shock

1551

Impact tests

441, 1337, 1682, 1685, 1689,
2156, 2355, 2456

Impedance matching technique

214

Impedance technique

21, 951

Impedance

1929

Impellers

453, 454, 1070, 1071, 1072, 1073

Abstract

Numbers: 1-182 183-444 445-652 653-864 865-1065 1066-1263 1264-1466 1467-1766 1767-2002 2003-2199 2200-2406 2407-2618

Volume 17

Issue: 1 2 3 4 5 6 7 8 9 10 11 12

Impulse response
399, 423, 557, 558, 851, 1439,
1616, 1643, 1663, 2153, 2154,
2497

Impulse testing
93, 394

Indentation
1662

Induction motors
765

Industrial facilities
337, 948, 1077, 1190, 1483

Industrial noise
254

Inelastic materials
40

Inertial forces
554, 580, 710, 846, 1861

Inflatable structures
2196

Initial deformation effects
262, 447, 580, 701, 730, 2246,
2536

Instrumentation mounts
256

Instrumentation
157, 158, 404, 621, 634, 824,
1014, 1185, 1369

Integral equations
421

Integration methods
743, 1488

Interaction: structure-support
2326

Interactive computing
1609

Interferometric techniques
538, 632, 1236, 1676, 2155

Interior noise
512, 528, 687, 1119, 1306, 1537,
1544, 1819, 1820, 2040, 2431,
2432, 2433, 2434, 2435, 2436,
2461, 2506, 2558

Internal combustion engines
456, 457, 1508

Internal damping
119, 202, 368, 612, 796, 1499,
2135

Internal friction
1058, 1220, 1780

Internal resonance
554, 925, 2187

Iron
619

Isolators
530

Isotropy
576

Iteration
642, 975, 1487, 1594, 1733, 2575

- J -

Jet noise
2111, 2348, 2349, 2570

Joint stiffness
2527

Joints (anatomy)
1559

Joints (junctions)
916

Abstract

Numbers: 1-192 193-444 445-652 653-864 865-1066 1067-1263 1264-1466 1467-1766 1767-2002 2003-2199 2200-2406 2407-2618

Volume 17

Issue:	1	2	3	4	5	6	7	8	9	10	11	12
--------	---	---	---	---	---	---	---	---	---	----	----	----

Joints
59, 60, 62, 63, 188, 266, 549,
550, 600, 716, 737, 1142, 1143,
1321, 1536, 1607, 1879, 2031,
2251, 2252, 2338, 2525, 2526,
2529

Journal bearings
55, 215, 278, 284, 543, 544, 706,
707, 708, 709, 710, 1323, 1324,
1575, 1576, 1578, 1873, 1875,
1876, 2009, 2521, 2522

- K -

Kalman filter technique
280, 650

Keys
714

Kilns
929

- L -

Lagrange equations
887, 1250

Laminates
74

Lanczos method
642, 1986

Landing gear
249

Landing
1551

Laplace transformation
1618, 2266

Large amplitudes
73, 309

Laser structures
1428, 1567

Lasers
1062, 1236, 1245, 1724, 1766,
1960, 2019, 2067, 2381, 2416

Laser-Doppler method
1725

Lateral vibrations
195, 228, 448, 1502

Lathes
234, 2423

Launching response
2478

Launching
2476

Layered damping
2578

Layered materials
21, 81, 385, 435, 582, 586, 618,
637, 756, 757, 808, 812, 1195,
1332, 1339, 1658, 1661, 1662,
1802, 1909, 1911, 2241, 2242,
2281, 2290, 2542, 2543, 2550,
2559, 2561

Leading edges
2369

Least squares method
280, 315, 1025, 1198, 1469, 2113

Legendre functions
177

Line source excitation
2088

Linear systems
1254, 1257, 1260, 2133, 2365,
2580

Linear theories
1709, 1950, 2189, 2587

Linearization methods
1249

Abstract

Numbers: 1-192 193-444 445-652 653-864 865-1055 1056-1263 1264-1496 1497-1756 1757-2002 2003-2199 2200-2406 2407-2618

Volume 17

Issue: 1 2 3 4 5 6 7 8 9 10 11 12

Linings
90, 258, 282, 1351, 2340, 2356

Linkages
66, 907, 1144, 1145, 1146, 1751,
1779, 2529

Liquid propellant rocket engines
1856

Liquids
782, 1485

Locality principle
848

Longitudinal vibrations
908, 1916, 2536

Longitudinal waves
720, 1328

Loss factor
1388

Lubrication
48, 49, 864, 1405, 1575, 2159

Lumped mass method
660

Lumped parameter method
172, 1254, 1265, 1730, 1984, 2188

Lyapunov's method
185, 2188, 2194

- M -

Machine foundations
442, 1565, 1596, 1793, 1794,
1795, 1796

Machine tools
12, 148, 459, 460, 461, 462, 626,
872, 873, 874, 875, 1509, 1510,
1511, 1513, 1724, 1729, 1771,
1772, 1773, 1774, 1975, 2022,
2023, 2024, 2025, 2027, 2173

Machinery noise
337, 341, 774, 792, 1317, 2136

Machinery vibration
429, 644, 696, 830, 1009, 1021,
1031

Machinery
1027, 1187, 1244, 1248, 2376,
2397, 2508

Machines
2002

Machining
133, 1075, 1281

Macroelement method
1737

Magnetic bearings
204, 705

Magnetic coils
806

Magnetic suspension techniques
1971, 283, 1109

Magnetic tapes
1207

Mapping
169

Marine engines
1272

Marine propellers
273

Marine risers
941, 1809, 1810, 1811, 1812

Masonry
667, 1788

Mass coefficients
290, 972, 985, 1747

Abstract

Numbers: 1-192 193-444 445-652 653-864 865-1055 1056-1263 1264-1466 1467-1756 1757-2002 2003-2199 2200-2408 2409-2618

Volume 17

Issue: 1 2 3 4 5 6 7 8 9 10 11 12

Mass matrices
1330, 1493, 1705, 1708, 1714,
2592

Mass-beam systems
1893, 1894, 2261

Mass-plate systems
1905

Mass-spring systems
114, 1596

Material damping
371, 792, 897, 991, 1213, 1388,
2290

Materials handling equipment
14, 1778

Materials
372, 907

Mathematical models
7, 183, 240, 444, 524, 688, 796,
846, 853, 854, 1311, 1520, 1630,
1717, 1730, 1781, 1785, 1799,
1991, 1992, 1993, 2023, 2073,
2121, 2213, 2258, 2321, 2399,
2400

Matrix methods
671, 1466, 1736

Matrix reduction methods
1451

Maximax response
1219

Maximum entropy spectral analysis
1454

Maximum likelihood method
1974, 1983

Measurement techniques
2108, 2380, 155, 827, 829, 831,
839, 1006, 1014, 1021, 1112,
1213, 1220, 1361, 1362, 1383,
(continued)

Measurement techniques (cont'd)
1407, 1420, 1640, 1677, 1679,
1694, 1725, 1826, 1869, 1929,
2066, 2132, 2151, 2312, 2378,
2379, 2381, 2385, 2427, 2430,
2431, 2593, 2596

Measuring instruments
1419, 156, 833, 1003, 1234, 1415,
1416, 1417, 1418, 1652, 1959,
1960, 2123

Mechanical admittance
400, 591

Mechanical components
96, 2376, 2584

Mechanical drives
445, 1584

Mechanical impedance
43, 79, 1734

Mechanical systems
1237

Mechanisms
860, 906, 2526

Membranes
308, 574, 575, 1273, 1610, 1898,
2100, 2539

Metal working
458

Metals
123, 377, 1200, 1215, 1218, 1246,
1496, 1645, 1668, 2586

Method of structural numbers
1984

Method of weighted residuals
1738

Microcomputers
429

Abstract

Numbers: 1-192 193-444 445-652 653-864 865-1065 1066-1263 1264-1496 1497-1756 1757-2002 2003-2199 2200-2406 2407-2618

Volume 17

Issue:	1	2	3	4	5	6	7	8	9	10	11	12
--------	---	---	---	---	---	---	---	---	---	----	----	----

Microphone technique
1423

Mindlin theory
1171

Minimum weight design
912, 1046

Mining equipment

2594

Missile launchers
1123, 2235

Missiles
521, 1124, 2402

Mobility method
10, 401, 706, 826, 1267, 1390,
1439, 1461, 1734

Modal analysis
147, 148, 149, 309, 390, 391,
452, 470, 573, 626, 627, 628,
820, 821, 822, 875, 986, 1004,
1009, 1010, 1013, 1015, 1020,
1025, 1052, 1053, 1233, 1266,
1267, 1269, 1270, 1273, 1274,
1276, 1277, 1278, 1280, 1281,
1292, 1321, 1325, 1331, 1340,
1345, 1346, 1359, 1377, 1390,
1392, 1393, 1394, 1400, 1408,
1424, 1425, 1426, 1427, 1433,
1434, 1435, 1436, 1437, 1438,
1440, 1441, 1442, 1443, 1444,
1445, 1446, 1447, 1448, 1449,
1450, 1451, 1453, 1454, 1455,
1456, 1457, 1458, 1460, 1463,
1464, 1465, 1467, 1471, 1481,
1493, 1500, 1510, 1512, 1531,
1534, 1535, 1553, 1554, 1555,
1565, 1567, 1574, 1592, 1595,
1610, 1612, 1614, 1616, 1623,
1634, 1637, 1643, 1644, 1699,
1700, 1701, 1702, 1703, 1704,
1705, 1706, 1707, 1708, 1709,
1710, 1711, 1712, 1713, 1714,
1715, 1716, 1717, 1718, 1719,
(continued)

Modal analysis (cont'd)
1720, 1722, 1730, 1731, 1732,
1734, 1735, 1736, 1738, 1754,
1772, 1773, 1816, 1819, 1820,
1831, 1896, 1942, 1953, 1961,
1962, 1977, 2014, 2121, 2149,
2229, 2255, 2282, 2447, 2490,
2493, 2494, 2540, 2582, 2587,
2588, 2589, 2591

Modal balancing technique
1482

Modal control technique
1738, 1840

Modal coordinates
1490

Modal damping
520, 1855, 2501, 2581

Modal extraction method
1438

Modal filters
2608

Modal models
2388

Modal scaling
1690, 1719

Modal superposition methods
570, 1008, 1266, 1527, 1616,
1465, 1853

Modal synthesis
497, 818, 819, 1356, 1376, 1511,
1532, 1537, 1606, 1721, 1855,
1963, 2388, 2488, 2581

Modal tests
569, 2383

Modal truncation
1376

Mode acceleration method
2462

Abstract

Numbers: 1-192 193-444 445-652 653-864 865-1055 1056-1263 1264-1496 1497-1756 1757-2002 2003-2199 2200-2406 2407-2616

Volume 17

Issue:	1	2	3	4	5	6	7	8	9	10	11	12
--------	---	---	---	---	---	---	---	---	---	----	----	----

Mode approximation technique
308

Mode displacement method
2462

Mode indicator function
1691

Mode shapes
3, 191, 252, 318, 361, 454, 466,
472, 508, 518, 519, 541, 572,
588, 589, 590, 630, 666, 752,
755, 783, 816, 916, 922, 930,
931, 982, 1092, 1096, 1162, 1164,
1274, 1278, 1280, 1310, 1336,
1340, 1512, 1590, 1610, 1612,
1620, 1624, 1626, 1646, 1664,
1687, 1719, 1752, 1914, 1989,
2019, 2029, 2056, 2080, 2281,
2287, 2297, 2491, 2492, 2499,
2538, 2549, 2555, 2581, 2587,
2595, 2614

Model testing
1846

Mode-amplitude technique
1947

Modulation functions
1043

Monitoring techniques
162, 166, 233, 287, 408, 412,
415, 638, 639, 640, 843, 844,
845, 874, 1027, 1028, 1029, 1030,
1031, 1075, 1084, 1244, 1248,
1483, 1726, 1727, 1728, 1729,
1974, 1975, 2168, 2173, 2174,
2175, 2176, 2177, 2178, 2179,
2180, 2602

Monte Carlo method
488, 489

Moorings
1813

Motion-limiting stops
1331

Motor vehicle noise
505, 528

Motor vehicles
885, 2414, 2431, 2434, 2445, 2591

Motorcycles
2062, 2503, 2597

Motors
1028, 1923, 2169

Mountings
196, 1965, 2179

Moving loads
45, 302, 465, 559, 972, 1078,
1517, 1783, 1784, 1889, 2205,
2426, 2535, 2546

Mufflers
1128, 1566, 1933, 2112, 2566

Multibearing rotors
214

Multidegree of freedom systems
1449, 1391, 1451, 1731, 2497

Multimicrophone technique
1361

Multiple shakers
1410, 1411, 1412

Multiple sine dwell method
1552

Multipoint excitation technique
1303, 1432, 1552, 2150

Multistory buildings
18, 97, 470, 473, 475, 476, 477,
480, 484, 485, 665, 666, 877,
1083, 1084, 1085, 1086, 1688,
1785, 1787, 1788, 2207, 2208

Musical instruments
575, 2106

Abstract
Numbers: 1-192 193-444 445-652 653-864 865-1065 1066-1263 1264-1496 1497-1756 1757-2002 2003-2199 2200-2406 2407-2618

Volume 17

Issue: 1 2 3 4 5 6 7 8 9 10 11 12

NASTRAN (computer program)
30, 153, 434, 2402

Natural frequencies
4, 46, 74, 75, 88, 153, 191, 217,
226, 274, 299, 314, 318, 319,
321, 385, 454, 466, 472, 508,
519, 541, 572, 575, 579, 586,
588, 589, 590, 630, 642, 666,
698, 746, 751, 752, 755, 756,
765, 783, 784, 785, 837, 916,
922, 926, 930, 931, 982, 1092,
1096, 1164, 1175, 1237, 1272,
1273, 1274, 1278, 1280, 1310,
1336, 1340, 1343, 1448, 1491,
1512, 1519, 1590, 1596, 1612,
1619, 1620, 1624, 1626, 1636,
1646, 1664, 1743, 1761, 1888,
1893, 1903, 1913, 1989, 2029,
2056, 2105, 2278, 2287, 2297,
2378, 2491, 2492, 2499, 2538,
2549, 2553, 2555, 2561, 2581,
2595, 2614

Near field region
1937

Nelson principle
1429

Newmark method
1488

Noise barriers
340, 1373, 2564

Noise control
884, 953, 954, 1054, 1186, 1187,
1933, 2018, 2616

Noise generation
29, 105, 229, 245, 253, 457, 498,
596, 597, 609, 610, 674, 682, 683,
899, 952, 1120, 1121, 1133, 1187,
1763, 1765, 1869, 1885, 1937,
2003, 2015, 2017, 2038, 2039,
2062, 2063, 2070, 2071, 2115,
2253, 2328, 2346, 2357, 2512,
2563, 2567, 2571, 2572, 2573

Noise measurement
337, 403, 537, 686, 1014, 1118,
1190, 1476, 1543, 1679, 1846,
1851, 1852, 2018, 2417, 2430,
2431, 2502, 2594

Noise prediction
686, 1275, 1306, 1546, 1896,
2136, 2357, 2432

Noise reduction
11, 248, 329, 341, 455, 591, 658,
687, 792, 875, 1063, 1119, 1134,
1185, 1281, 1304, 1306, 1317,
1352, 1363, 1369, 1392, 1544,
1572, 1585, 1586, 1647, 1771,
1786, 1834, 1835, 2004, 2016,
2017, 2020, 2041, 2071, 2081,
2111, 2112, 2122, 2197, 2414,
2419, 2420, 2437, 2438, 2509,
2558, 2567, 2570

Noise source identification
894, 949, 1820, 2601

Noise transmission
29, 1307, 1611, 1844, 1845, 2540

Noise-induced excitation
2030

Nonconservative forces
1206

Nondestructive tests
163, 368, 631, 1143, 1245, 1247,
1288, 1478, 1725, 1780

Nonlinear response
1333, 1354, 2255

Nonlinear structures
2190

Nonlinear systems
430, 695, 822, 823, 828, 850,
856, 975, 1008, 1249, 1429, 1467,
1982, 2149, 2193, 2401

Abstract
Numbers: 1-192 193-444 445-662 663-884 885-1055 1056-1263 1264-1496 1497-1756 1757-2002 2003-2199 2200-2406 2407-2618

Volume 17

Issue: 1 2 3 4 5 6 7 8 9 10 11 12

Nonlinear theories
42, 184, 742, 749, 789, 818, 855,
915, 919, 924, 925, 1056, 1159,
1266, 1661, 1709, 1741, 1797,
1951, 2337, 2527, 2554

Nonparametric identification
technique
828

Nonsynchronous vibrations
1069, 868

Normal modes
2351

Nozzles
1348, 1634

Nuclear explosion effects
434, 1375

Nuclear explosions
109

Nuclear fuel elements
1532, 1533, 2224, 2225

Nuclear power plants
20, 27, 42, 166, 193, 259, 325,
326, 327, 335, 474, 492, 640,
675, 697, 1022, 1039, 1104, 1105,
1235, 1630, 1636, 1707, 1799,
1803, 1804, 2032, 2222, 2226

Nuclear reactor components
23, 323, 499, 500, 838, 1292,
1293, 1313, 1533, 1534, 1631,
1637, 1803, 2222, 2301, 2302,
2339

Nuclear reactor containment
95, 2223

Nuclear reactor safety
192, 1532

Nuclear reactors
24, 25, 26, 162, 192, 242, 260,
440, 639, 880, 881, 882, 945,
(continued)

Nuclear reactors (cont'd)
946, 1102, 1103, 1289, 1290,
1291, 1531

Nuclear weapons effects
30

Numerical analysis
270, 416, 417, 428, 429, 539,
644, 857, 999, 1035, 1103, 1252,
1256

Numerical methods
39, 1159, 1323, 1463, 1467, 1527,
1559, 1741, 1746, 1910, 1985,
2184, 2295, 2393

Nutation dampers
2372

- O -

Oceans
438, 766, 1934

Off-highway vehicles
1562, 1563, 1823, 1858, 2447

Off-road vehicles
2048, 2049

Off-shore structures
28, 243, 244, 501, 502, 550, 645,
843, 878, 883, 942, 1156, 1294,
1295, 1296, 1535, 1805, 1806,
1807, 1808, 1810, 1811, 1812,
2227, 2228, 2277, 2428, 2429,
2562

Oil dampers
2131

Oil film bearings
280

Oil film
864

Oil whip phenomena
230

Abstract

Numbers: 1-192 193-444 445-652 653-864 865-1055 1056-1263 1264-1496 1497-1756 1757-2002 2003-2199 2200-2406 2407-2618

Volume 17

Issue: 1 2 3 4 5 6 7 8 9 10 11 12

Oil whirl phenomena
281

Oil-film bearings
1214

Optical measuring instruments
2382

Optical methods
156, 2381, 2385

Optimization
44, 203, 320, 321, 402, 433, 563,
651, 1160, 1259, 1342, 1708,
2135, 2137, 2181, 2194, 2279,
2393, 2448, 2483, 2495, 2596,
2603

Optimum control theory
177, 2482

Optimum design
190, 531, 562, 689, 736, 860,
1551, 1749, 2195, 2508

Organs (biological)
1126

Organs (musical instruments)
2107

Orthotropism
576, 754, 756, 1336, 1689, 1745,
2099, 2552

Oscillating conveyors
1777

Oscillations
2107

Oscillators
171, 643, 1044, 2130

Overhead cranes
15, 659, 1514

- P -

Panels
741, 950, 1611, 1844, 1899, 1900,
1909, 2093, 2094, 2343, 2540,
2541

Paper products
1077, 1483

Parallelepiped bodies
339

Parameter identification technique
189, 431

Parametric excitation
181, 739, 780, 915, 979, 1208,
1252, 1446, 1951, 2128, 2185

Parametric resonance
182, 559, 747, 748, 933, 1204,
2322

Parametric response
259, 776

Parametric vibration
286, 701, 1060, 1884

Pavement roughness
676

Pavements
241

Pendulums
1386, 1985

Penetration
607

Period structures
2395

Periodic excitation
171, 297, 301, 566, 577, 654,
747, 748, 1189, 1259, 1297, 1412,
1429, 1430, 1506, 1884, 1905,
2365, 2551

Abstract

Numbers: 1-192 193-444 445-652 653-864 865-1065 1066-1263 1264-1496 1497-1756 1757-2002 2003-2199 2200-2406 2407-2618

Volume 17

Issue: 1 2 3 4 5 6 7 8 9 10 11 12

Periodic response
 426, 553, 711, 827, 833, 852,
 906, 1260, 1598, 1747, 1821,
 1982, 2187

Periodic vibration
 872, 2551

Perturbation theory
 191, 416, 427, 727, 781, 811,
 852, 1037, 1137, 1148, 1149,
 1252, 1358, 1487, 1653, 1717,
 1733, 1736, 1979, 2116

Phase methods
 1041

Photoelastic analysis
 156, 1007

Photographic techniques
 2311

Piezoelectric properties
 2288

Piezoelectric shakers
 635

Piezoelectric transducers
 835

Piezoelectricity
 2484

File driving
 1798

File foundations
 671, 672, 2214

File structures
 235, 877, 1285, 1286, 1797, 2034

Pipe joints
 1914

Pipelines
 164, 532, 592, 593, 594, 595,
 943, 954, 1349, 1631, 1634, 1638,
 2222, 2301, 2302, 2562

Pipes
 83, 84, 257, 258, 323, 324, 325,
 499, 942, 944, 949, 1176, 2106,
 2107, 2130, 2300, 2322, 2338

Piping systems
 9, 22, 42, 85, 86, 87, 259, 326,
 327, 439, 940, 945, 946, 992,
 1313, 1350, 1630, 1632, 1633,
 1914, 1918

Pistons
 923, 956

Plastic properties
 1602, 2054, 2091

Platens
 2292

Plates
 73, 74, 75, 76, 79, 80, 81, 308,
 309, 313, 315, 386, 576, 577,
 578, 579, 582, 599, 637, 732,
 742, 743, 744, 793, 820, 923,
 924, 925, 926, 927, 928, 1142,
 1171, 1172, 1173, 1337, 1338,
 1613, 1614, 1615, 1626, 1761,
 1901, 1903, 1906, 1926, 1927,
 1944, 1957, 2095, 2097, 2100,
 2124, 2148, 2226, 2280, 2282,
 2283, 2284, 2285, 2314, 2542,
 2543, 2544, 2545, 2546, 2547,
 2548

Pneumatic tires
 506

POGO effect
 1856

Point mapping method
 170

Point masses
 2089

Point source excitation
 772, 1384, 2114

Abstract

Numbers: 1-192 193-444 445-652 653-864 865-1055 1056-1263 1264-1496 1497-1756 1757-2002 2003-2199 2200-2406 2407-2618

Volume 17

Issue: 1 2 3 4 5 6 7 8 9 10 11 12

Polymers
 371, 977

Polynomial analysis
 790

Polyreference method
 1437, 1438

Porous materials
 420, 422, 984, 985, 1484, 2066,
 2146, 2189, 2340

Positioning devices (machinery)
 1516

Power generators (electric)
 1481

Power plants
 67, 197, 238, 2178

Power series method
 1624, 1744, 2213

Power spectra
 2394

Power spectral density
 2561, 1040, 2349

Power transmission systems
 203, 1074, 1818, 2045, 2422

Prediction techniques
 135, 146, 222, 350, 351, 352,
 353, 354, 377, 379, 521, 800,
 866, 871, 955, 1396, 1474, 2055,
 2313, 2563, 2599

Presses
 658, 2080

Pressure gages
 157

Pressure vessels
 22, 25, 1288

Prestressed concrete
 1603

Prestressed structures
 2533

Printing
 1516, 2080

Probability density function
 646

Probability theory
 1044, 1218

Proceedings
 1054, 1389, 2197, 2616

Projectile penetration
 1173

Propeller blades
 273, 274, 275, 276, 537, 540,
 899, 1570, 1572, 1573, 1574,
 1870, 2060, 2073, 2518, 2519

Propellers
 403, 512, 952, 1937, 2006

Protective shelters
 331, 356, 970, 1375

Protective shields
 2054

Proximity probes
 1057, 1455

Pseudo shock waves
 578, 596, 597

Pulse excitation
 306, 1159, 1199, 1329, 1949, 2090

Pulse testing techniques
 402

Pumps
 162, 193, 194, 293, 295, 865,
 1022, 1063, 1505, 1564, 1757,
 1758, 1769, 1856, 1880

Abstract

Numbers: 1-192 193-444 445-652 653-864 865-1055 1056-1263 1264-1496 1497-1756 1757-2002 2003-2199 2200-2406 2407-2618

Volume 17

Issue: 1 2 3 4 5 6 7 8 9 10 11 12

- Q -

Quasi-modal analysis
414, 1061

- R -

Racks
1180

Radial vibrations
702, 704, 708, 765, 2218, 2523

Rail wheel interaction
1832

Railroad bridges
662, 1078, 2205, 2426

Railroad cars
247, 503, 677, 678, 1829, 1830,
1831, 2175

Railroad tracks
680, 1825, 1969

Railroad trains
464, 533, 534, 971, 1215, 1517,
1783, 1784, 1827, 1832, 1864,
2205

Railroad wheels
683

Railway vehicles
2053

Railway wheels
1133, 1868

Rail-vehicle interaction
503, 679, 681, 1297

Rail-wheel interaction
29, 682, 1108, 1133, 1828, 1830,
2037, 2053

Random decrement technique
1447, 1449, 1535

Random excitation
5, 15, 289, 402, 430, 609, 610,
730, 918, 978, 1359, 1396, 1398,
1406, 1411, 1429, 1446, 1457,
1778, 2092, 2207, 2508

Random response
244, 501, 648, 789, 1043, 1451,
2394, 2399

Random vibrations
112, 154, 251, 332, 378, 421,
647, 734, 761, 788, 872, 910,
1203, 1243, 1756, 1776, 1892,
2061, 2390, 2574, 2618

Rating
1640, 1930

Rayleigh waves
813, 1381, 1958

Rayleigh-Ritz method
751, 1280, 1612, 2029, 2190,
2261, 2552

Reciprocating compressors
233, 1632, 1633, 1770, 2021

Reciprocating engines
456, 2420

Reciprocating pumps
2020

Recording instruments
833, 2384

Rectangular beams
561

Rectangular membranes
740, 1168

Rectangular panels
918

Rectangular plates
76, 310, 580, 581, 747, 748, 749,
750, 751, 919, 920, 921, 1170,
(continued)

Abstract

Numbers: 1-192 193-444 445-652 653-864 865-1055 1056-1263 1264-1496 1497-1756 1757-2002 2003-2199 2200-2406 2407-2618

Volume 17

Issue: 1 2 3 4 5 6 7 8 9 10 11 12

Rectangular plates (cont'd)
 1392, 1612, 1617, 1618, 1619,
 1621, 1693, 2096, 2288, 2289,
 2290, 2549, 2550, 2551, 2552,
 2553

Recursive methods
 1039

Reduction methods
 856, 1042, 2190, 2497

Regression analysis
 1689

Regulations
 1640, 2039

Reinforced concrete
 17, 18, 69, 97, 473, 476, 484,
 485, 607, 668, 778, 1099, 1179,
 1604, 1605, 1922, 1941, 2208,
 2268, 2298, 2425

Reliability
 131, 1996, 2092

Remote control
 1839

Resonance bar technique
 805

Resonance pass through
 1357

Resonance tests
 991

Resonant bar techniques
 2391

Resonant column tests
 2035

Resonant frequencies
 1474, 1622, 1976, 1977, 2181

Resonant response
 2, 543, 979, 1177, 1308, 1385,
 1776, 1847, 1924, 1948, 2045,
 2101

Resonators
 158, 2389

Response spectra
 1219, 1378

Response spectral density
 1451

Retaining walls
 2345

Reverberation time
 1677

Reverberation
 438

Reviews
 32, 112, 140, 144, 159, 175, 176,
 227, 441, 468, 483, 542, 574,
 598, 647, 1001, 1468, 1513, 1734,
 1945, 1955, 2085, 2097, 2203,
 2389

Rheological properties
 142

Ride dynamics
 1817, 2502, 2504, 2505

Rigid foundations
 213

Rigid rotors
 6, 215, 1503

Ring springs
 75

Rings
 83, 735, 939, 1567, 1629, 1913,
 2105

Abstract

Numbers: 1-182 183-444 445-652 653-864 865-1055 1056-1263 1264-1486 1487-1756 1757-2002 2003-2198 2200-2408 2407-2618

Volume 17

Issue: 1 2 3 4 5 6 7 8 9 10 11 12

Ritz method
740, 746, 920, 931, 1626, 2096,
2548

Riveted joints
2232

Road roughness
788

Roads
241

Road-vehicle interaction
2065

Robots
641, 1045, 1076, 1515, 1779

Rock drills
674

Rocket engines
1757, 1758, 1769

Rocks
2033

Rods
348, 554, 555, 674, 722, 908,
909, 1157, 1158, 1171, 1722,
1883, 2087, 2089, 2260

Roller bearings
48, 49, 213, 1136, 1972

Rolling contact bearings
845, 1321, 1579, 1728, 2158,
2159, 2174, 2175, 2249

Rolling element bearings
408

Rolling friction
2245

Roofs
762, 948, 1353

Rooms
330, 764, 955

Rotating machinery
10, 265, 408, 1056, 1504, 2011,
2176, 2177, 2180, 2201

Rotating structures
223, 453, 939, 1280, 1422, 1494,
2200

Rotational degrees of freedom
1425, 1493, 1704

Rotational mode shapes
2589

Rotational speed effects
939

Rotatory inertia effects
46, 80, 309, 561, 581, 757, 1271,
1273, 1343, 1427, 1591, 1893,
2286, 2545, 2546

Rotor blades (turbomachinery)
222, 238, 268, 406, 702, 703,
1318, 2247

Rotor blades
2517

Rotors
60, 193, 194, 198, 199, 200, 204,
206, 207, 210, 211, 212, 217,
218, 220, 221, 224, 225, 226,
227, 228, 230, 231, 232, 233,
294, 392, 410, 414, 446, 449,
452, 654, 657, 867, 870, 871,
1010, 1015, 1025, 1026, 1058,
1059, 1209, 1264, 1265, 1266,
1267, 1481, 1497, 1499, 1547,
1688, 1757, 1758, 1760, 1761,
1762, 1973, 2006, 2007, 2060,
2160, 2171, 2409, 2410, 2411

Rotor-stator interaction
198, 2411

Rubs
68, 198, 870, 1973

Abstract

Numbers: 1-192 193-444 445-652 653-884 885-1055 1056-1263 1264-1496 1497-1756 1757-2002 2003-2199 2200-2406 2407-2618

Volume 17

Issue: 1 2 3 4 5 6 7 8 9 10 11 12

- S -

Safety restrain systems
1299

Sandwich structures
793, 912, 1906

Saws
2201

Scaling
1373, 1595

Screening
1756, 2618

Seals
68, 290, 291, 292, 293, 294, 295,
717, 718, 719, 1059, 1137, 1147,
1148, 1149, 1150, 1151, 1152,
1153, 1154, 1155, 1587, 1880,
2085, 2238

Seismic analysis
24, 42, 108, 149, 260, 317, 327,
473, 474, 478, 492, 496, 499,
1083, 1104, 1289, 1605, 1918,
1922, 2200, 2206, 2215, 2220,
2222

Seismic design
41, 63, 481, 482, 483, 486, 563,
668, 697, 778, 795, 948, 1127,
1350, 1787, 1804, 2206, 2209,
2243

Seismic excitation
95, 107, 335, 490, 570, 664, 779,
1291, 1349, 1378, 1519, 1627,
1799, 1983, 2212

Seismic isolation
1313, 1522

Seismic response spectra
17, 601, 669, 763

Seismic response
18, 20, 64, 65, 96, 97, 104, 235,
316, 345, 467, 475, 477, 479,
480, 485, 487, 529, 571, 650,
665, 667, 670, 675, 760, 761,
783, 877, 878, 881, 882, 937,
938, 940, 946, 1039, 1179, 1314,
1355, 1376, 1377, 1428, 1524,
1529, 1532, 1534, 1604, 1608,
1659, 1785, 1788, 1790, 1791,
1802, 1945, 1966, 2034, 2208,
2211, 2221, 2293, 2302, 2344,
2345, 2425

Seismic tests
242, 260, 346, 405, 476, 484,
636, 2301

Seismic waves
1001, 1198, 1746, 2126

Self-excited vibrations
535, 979, 2185, 56, 234, 281,
459, 608, 780, 870, 1065, 1208,
1387, 1881, 1951, 2047

Self-generating functions
749

Sensitivity analysis
1426

Servomechanisms
1924

Shafts
1, 2, 44, 195, 196, 197, 201,
406, 446, 447, 448, 450, 868,
869, 1057, 1060, 1062, 1270,
1271, 1500, 1501, 1502, 1762,
2008, 2009, 2010, 2165, 2202,
2407, 2408

Shakedown theorem
383, 627, 973, 2280

Shakers
393, 836, 1201

Shear deformation effects
1427

Abstract

Numbers: 1-192 193-444 445-652 653-864 865-1055 1056-1263 1264-1496 1497-1756 1757-2002 2003-2199 2200-2406 2407-2618

Volume 17

Issue: 1 2 3 4 5 6 7 8 9 10 11 12

Shear waves
1193

Shells of revolution
318, 752, 758, 932, 1623, 2104

Shells
24, 226, 299, 322, 700, 738, 742,
820, 929, 931, 933, 968, 1342,
1621, 1622, 1626, 1909, 1910,
1957, 2101, 2102, 2212, 2285,
2298, 2558, 2559, 2560

Ship hulls
684, 888

Ship noise
2094

Ship vibrations
509

Shipboard machinery
1029, 1031

Ships
508, 553, 887, 1541, 2230

Shock absorbers
257, 258, 1123, 1132, 2064, 2241,
2242

Shock excitation
105, 777, 1309

Shock isolation
530, 897, 2235

Shock isolators
2139

Shock pulse method
2159

Shock resistant design
1374

Shock response
762, 1940, 2416

Shock tube testing
434

Shock tubes
160

Shock wave - boundary layer
interaction
608, 776, 1380

Shock wave propagation
106, 1939

Shock waves
347, 348, 349, 435, 605, 809,
815, 909, 1047, 1379, 1381, 1672,
1798, 1942, 1943, 2125, 2571,
2572, 2573

Shrouds
2415

Signal compression method
396

Signal processing techniques
150, 151, 287, 396, 1003, 1239,
1639, 2386

Signature analysis
1017, 1281

Silencers
2570

Simulation
233, 862, 1076, 1200, 1479, 1638,
1813, 1818, 1829, 1966, 2283

Single degree of freedom systems
426, 1202

Single-plane balancing
409

Slabs
339

Slider bearings
1581

Abstract

Numbers: 1-182 193-444 445-662 663-884 885-1066 1066-1283 1284-1496 1497-1756 1757-2002 2003-2199 2200-2406 2407-2618

Volume 17

Issue: 1 2 3 4 5 6 7 8 9 10 11 12

Slider crank mechanisms
2195

Sliding friction
486, 489

Slip joints
2339

Slip rings
1481

Sloshing
113, 936, 938, 1293, 2588

Snap through problems
730

Snubbers
42, 259, 260, 2301

Soil tire interaction
2513

Soils
237, 1791, 1792, 1929, 2035,
2218, 2219

Soil-foundation interaction
1101

Soil-structure interaction
20, 21, 370, 474, 478, 490, 491,
492, 495, 670, 671, 675, 832,
877, 879, 944, 1104, 1105, 1285,
1289, 1376, 1755, 1798, 1799,
1800, 1801, 1802, 2215, 2216,
2217

Solid propellant rocket engines
1125, 1853

Solid propellants
400

Solid-structure interaction
1826

Sonars
1651

Sonic boom
764

Sound generation
775, 954, 1125, 1363, 1871, 1880,
1936, 1938, 2106

Sound insertion loss
1566

Sound intensity
155, 1021

Sound measurement
276, 1360, 1362, 1372, 2427

Sound pressure levels
955

Sound pressures
1372, 1928

Sound propagation
336

Sound transmission loss
1305, 1649, 1931, 2117

Sound transmission
1283, 1368, 1641, 1653, 1921,
2478

Sound waves
84, 91, 92, 93, 94, 98, 99, 101,
102, 329, 330, 338, 339, 340,
342, 343, 399, 456, 598, 604,
605, 656, 680, 693, 716, 767,
768, 769, 770, 771, 773, 811,
947, 950, 956, 960, 962, 963,
964, 965, 966, 967, 968, 984,
1120, 1189, 1194, 1351, 1364,
1365, 1366, 1367, 1368, 1371,
1599, 1613, 1648, 1655, 1656,
1657, 1672, 1907, 1914, 1926,
1932, 1990, 2040, 2088, 2113,
2114, 2116, 2118, 2119, 2120,
2121, 2340, 2341, 2347, 2348,
2351, 2352, 2353, 2564, 2568,
2569

Abstract

Numbers: 1-192 193-444 445-652 653-864 865-1055 1056-1263 1264-1496 1497-1756 1757-2002 2003-2199 2200-2406 2407-2618

Volume 17

Issue:	1	2	3	4	5	6	7	8	9	10	11	12
--------	---	---	---	---	---	---	---	---	---	----	----	----

Space shuttles
251, 369, 1240, 1279, 1505, 1553,
2402, 2475, 2490

Space stations
519

Space structures
252

Spacecraft antennas
2498, 2499, 2500, 2501

Spacecraft components
37, 39, 690, 1122, 1757, 1758,
1854, 2478

Spacecraft
38, 147, 516, 518, 520, 611, 691,
719, 819, 825, 1213, 1216, 1309,
1310, 1552, 1554, 1555, 1595,
1855, 2237, 2239, 2282, 2476,
2477, 2479, 2480, 2481, 2482,
2483, 2484, 2485, 2487, 2488,
2489, 2491, 2492, 2493, 2494,
2495, 2496, 2497

Spalling
1200

Spectral analysis
1192, 1459, 1492

Spectrum analysis
629, 1232, 2075, 2344

Spectrum analyzers
1005, 1483

Spheres
968, 1175

Spherical shells
82, 321, 753, 754, 934, 1343,
1628, 1902, 1911, 1912

Spindles
459

Spline technique
1748, 2589

Spoilers
362

Spring constants
266

Springs
930, 1317, 1562, 1751

Spur gears
201, 713, 714, 2082

Squeal
1868

Squeeze-film bearings
360, 705, 898, 900, 1212

Squeeze-film dampers
118, 120, 365, 367, 615, 616,
987, 988, 1210, 1211, 1666, 1954,
2556, 2579

Stability analysis
424, 2125

Stability
6, 12, 37, 66, 176, 215, 218,
221, 224, 225, 278, 294, 301,
464, 507, 544, 545, 557, 560,
1058, 1176, 1206, 1251, 1499,
1503, 1576, 1791, 1814, 2396,
2477, 2577, 2605, 2609

Stalling
275, 2055, 2233, 2411, 2412, 2413

Standards and codes
668, 839, 1282

Standards
443, 498, 1014, 1055, 2617

Standing waves
657

State space approach
659, 676, 684, 1453, 1713

Abstract

Numbers: 1-192 193-444 445-682 683-864 865-1055 1056-1263 1264-1496 1497-1756 1757-2002 2003-2196 2200-2408 2407-2618

Volume 17

Issue: 1 2 3 4 5 6 7 8 9 10 11 12

Statistical analysis
645, 648, 665, 959, 1447, 1539,
1639, 1996

Statistical energy analysis
59, 1186

Statistical energy methods
332, 1642, 2094, 2434

Statistical linearization
5

Stators
765

Steam turbines
46, 216, 271, 272, 655, 902,
1319, 1507, 1764, 2166

Steel
61, 127, 141, 143, 373, 379, 380,
381, 477, 548, 778, 791, 995,
1081, 1097, 1098, 1100, 1170,
1180, 1226, 1227, 1228, 1230,
1395, 1399, 1403, 2042, 2140,
2141, 2143, 2209, 2267, 2584

Stick-slip response
168, 1880

Stiffened beams
1599

Stiffened panels
1169

Stiffened plates
2289

Stiffened shells
1174

Stiffened structures
803, 886

Stiffener effects
579, 2289

Stiffness coefficients
237, 279, 282, 290, 291, 292,
293, 365, 461, 718, 790, 1073,
1137, 1139, 1295, 1321, 1327,
1525, 1576, 1578, 1747, 1801,
1825, 1875, 1955, 2027, 2074,
2075, 2410, 2592

Stiffness effects
504, 807, 972

Stiffness matrices
1330, 1493, 1705, 1708, 1714

Stiffness methods
731

Stochastic processes
72, 185, 186, 430, 489, 647, 736,
800, 878, 957, 994, 1040, 1222,
1290, 1354, 1404, 1573, 1669,
1805, 1995, 2050, 2051, 2086,
2477

Storage tanks
936, 937, 938, 1627

Storage
344

Strain energy density
854

Strain frequency response func-
tions
1402

Strain gages
394, 2152

Strain hardening
1158

Strain rate
1861, 2266

Stress analysis
801, 2403

Stress elements
1947

Abstract

Numbers: 1-182 183-444 445-852 853-884 885-1055 1056-1283 1284-1496 1497-1756 1757-2002 2003-2196 2200-2406 2407-2618

Volume 17

Issue: 1 2 3 4 5 6 7 8 9 10 11 12

Stress intensity factors
997, 998, 999, 1629, 2103

Strings
555, 1588, 1589, 1881, 2086

Structural damping
2236

Structural members
332, 333, 619, 993, 1107, 1354,
1355, 1356, 1357, 1553, 1595,
1645, 1844, 1845, 1922, 2110,
2226, 2441, 2447, 2458

Structural modification tech-
niques
191, 1364, 1721

Structural resonance
1642

Structural response
287, 404, 431, 493, 1032

Structural synthesis
2604

Structure borne noise
1537, 2031, 2558, 2565

Structure-fluid interaction
107, 117, 1048

Structure-foundation interaction
196, 442, 489, 493, 1233, 2214

Structure-support interaction
1347, 1355, 1356, 1358, 2314,
2323

Struts
1167

Studs
64

Subharmonic oscillations
167, 181, 305, 780, 883, 1056,
1204, 1894, 1951

Submerged structures
303, 510, 567, 685, 980, 1541,
1895, 2101, 2257, 2267, 2541

Submersed structures
2428, 2429

Substructuring methods
2589, 23, 395, 418, 496, 497,
849, 1105, 1276, 1466, 1555,
1606, 1736, 1739, 1855, 1963,
1988, 2014, 2182, 2425, 2449,
2604

Subsynchronous vibrations
1059, 1067, 1068, 1279, 1507,
2009, 2012, 2165

Subway cars
246

Subway railways
246

Successive approximation method
2227

Sum and difference frequencies
2010

Summation of forces method
2462

Superharmonic vibrations
2128, 1894

Supersonic aircraft
1835, 1836

Supersonic frequencies
1318

Supports
44, 256, 320, 532, 1209, 1313,
1635, 1897, 1917, 2021, 2323,
2499

Surface roughness
127, 717, 781, 1148, 1149, 1581,
2357, 2568

Abstract

Numbers: 1-192 193-444 445-662 663-884 885-1065 1066-1283 1284-1496 1497-1756 1757-2002 2003-2199 2200-2406 2407-2818

Volume 17

Issue: 1 2 3 4 5 6 7 8 9 10 11 12

Surge
7, 9

Suspended structures
2338

Suspension bridges
466, 467, 661, 1082

Suspension systems (vehicles)
261, 265, 463, 464, 503, 533,
534, 677, 694, 695, 1315, 1316,
1562, 1563, 1816, 1862, 1864,
1865, 1866, 1867, 2051, 2065,
2240

Switches
1359

Synchronous motors
868

Synchronous vibrations
870

System identification
1548, 1743, 1744, 1997, 187, 188,
432, 650, 822, 1013, 1106, 1257,
1258, 1466, 1468, 1797, 2609,
485, 1999

- T -

Tanks (combat vehicles)
2593

Tanks (containers)
316, 317, 368, 591, 2293, 2294,
2295

Temperature effects
95, 210, 322, 505, 556, 583, 933,
962, 1324, 1575, 1592, 1899, 2166

Tensile strength
1242, 2033, 2156

Test data
748

Test equipment
836, 1968, 2052

Test facilities
160, 393, 406, 1216, 1235, 1240,
1475, 1477, 1531, 1538, 1964,
1966, 1969, 1971, 2392, 2597

Test models
1373, 1608

Testing instrumentation
837, 1239

Testing techniques
22, 124, 159, 163, 346, 404, 405,
465, 571, 621, 799, 999, 1007,
1401, 1682, 1683, 1684, 1685,
1781, 1792, 2052, 2391, 2443,
2450, 2496, 2617, 2618

Textiles
1762

Theory of adaptive identifiers
1748

Thermal insulation
838, 1680

Thermoelasticity
173

Thrust bearings
51, 52, 53, 54, 1322, 1582

Tiles
1643

Tilt pad bearings
209, 655, 712, 902, 2521

Time dependent excitation
1256

Time dependent parameters
1488, 2394

Abstract

Numbers: 1-182 183-444 445-652 653-864 865-1055 1056-1263 1264-1496 1497-1756 1757-2002 2003-2199 2200-2406 2407-2618

Volume 17

Issue: 1 2 3 4 5 6 7 8 9 10 11 12

Time domain method
178, 275, 391, 397, 423, 488,
491, 828, 836, 876, 1038, 1106,
1194, 1296, 1334, 1467, 1695,
1735, 1743, 1746, 1747, 1800,
1801, 1813, 1849, 2153, 2214,
2255, 2418, 2490, 2582

Time response loops
1946

Time series analysis method
1454, 1542, 2607

Time-delay systems
1998

Timoshenko theory
70, 558, 723, 727, 734, 1277,
1598, 1891, 2264, 2266, 2268

Tires
535, 1568, 2070, 2071, 2512

Tire-pavement interaction
1869

Tire-vehicle systems
1568

Tire-wheel interaction
45, 2043

Tools
2201

Topological methods
1984

Torque excitation
451

Torque
1057

Torsional excitations
411, 995, 1157, 1268, 1901, 562

Torsional response
19, 467, 478, 479, 540, 653,
2364, 2421

Torsional vibrations
1, 201, 208, 212, 366, 445, 450,
560, 621, 708, 726, 830, 904,
908, 913, 921, 929, 1016, 1039,
1160, 1272, 1278, 1415, 1501,
1502, 1506, 1597, 1601, 1887,
1888, 1916, 1997, 2013, 2078,
2259, 2408, 2409, 2422, 2534,
2536

Towed systems
553

Towers
878, 1092, 1093, 1094, 1156,
1284, 1789, 1808

Tracked vehicles
1824, 1826, 1964, 2593

Tractors
1821, 1822, 2229

Traffic noise
341, 1539, 1558, 1930, 2437, 2503

Traffic-induced vibrations
465, 663, 1540

Transducers
397, 401, 404, 834, 1011, 1012,
1238, 1419, 1924, 2152

Transfer functions
279, 399, 1276, 1410, 1695, 2026

Transfer matrix method
87, 855, 1499, 1501, 1598, 2291,
2395

Transient analysis
175, 587, 2134, 2186, 2476

Transient excitation
654, 898, 1411, 2227, 2284, 2475

Transient response
7, 70, 77, 157, 173, 221, 270,
420, 440, 495, 558, 833, 863,
1050, 1638, 1748, 1905, 2095,
2192, 2194, 2439, 2500, 2533

Abstract

Numbers: 1-192 193-444 445-852 853-894 895-1065 1066-1263 1264-1496 1497-1756 1757-2002 2003-2196 2200-2406 2407-2618

Volume 17

Issue: 1 2 3 4 5 6 7 8 9 10 11 12

Transient vibrations
194, 2551

Transient waves
914

Transmissibility functions
1707

Transmission lines
551, 552, 1953, 2258, 2259

Transmissivity
1644

Transportation vehicles
886, 1832

Transverse shear deformation
effects
46, 81

Trucks
16, 505, 506, 2046, 2437, 2438,
2504, 2505, 2511, 2512

Truncation
1554, 1555, 1710

Trusses
573, 917

Tube arrays
1178, 1346, 2303, 2304, 2305,
2306, 2307, 2308, 2309, 2310,
2311, 2312, 2313, 2314, 2315,
2316, 2317, 2320, 2321, 2325,
2328, 2329, 2330, 2331, 2332,
2333, 2334, 2335, 2336

Tubes
88, 89, 296, 328, 572, 1131,
1177, 1347, 1348, 1422, 1635,
1636, 1637, 1916, 1917, 2323,
2324, 2326, 2327, 2337, 2339,
2458

Tubing
157

Tuning
44, 211, 536, 657, 699, 904,
1356, 1358, 1665, 1770, 2415,
2515, 2520

Tunnel linings
1970

Tunnels
606, 1527

Turbine blades
46, 161, 216, 217, 267, 270, 271,
272, 538, 556, 632, 700, 1135,
1319, 1665, 1872, 2246

Turbine components
410, 1500, 1768

Turbine engines
367, 1477, 1569, 1768, 2172

Turbines
164, 607, 712, 1276

Turbofans
699

Turbogenerators
208, 209, 210, 211, 212, 415,
1277, 1278, 1766, 1767, 2030,
2157

Turbomachinery blades
542, 2402

Turbomachinery
60, 223, 409, 841, 866, 905,
1058, 1211, 1279, 1793, 1794,
1973, 2076, 2162, 2202, 2409,
2600

Turbulence
84, 223, 292, 349, 709, 710, 775,
1125, 1188, 1210, 1573, 1875,
2273, 2283, 2308, 2327, 2379,
2380, 2521

Two degree of freedom systems
1382, 1446, 1962, 2187, 2192

Abstract

Numbers: 1-192 193-444 445-652 653-864 865-1065 1066-1263 1264-1496 1497-1756 1757-2002 2003-2196 2200-2406 2407-2618

Volume 17

Issue: 1 2 3 4 5 6 7 8 9 10 11 12

Two microphone techniques
155, 958, 2108

- U -

Ultrasonic resonance
1338

Ultrasonic techniques
163, 834, 1970

Ultrasonic vibration
791

Unbalanced mass response
60, 167, 206, 207, 209, 213, 220,
221, 413, 655, 712, 905, 1502,
2410

Undamped structures
1382, 1963

Underground explosions
1987

Underground structures
495, 938, 944, 1349, 1350, 1527,
1528

Underwater explosions
606

Underwater pipelines
1915, 2338

Underwater sound
98, 99, 100, 338, 438, 766, 767,
958, 960, 961, 962, 963, 965,
1360, 1368, 1484, 1485, 1486,
1654, 1655, 1656, 2350, 2351,
2352, 2353

Underwater structures
380, 1942

Universal joints
195, 448, 449

Urban noise
522, 957

- V -

Valves
67, 149, 1586, 2139, 2253, 2254,
2530

Van der Pol method
780, 1208

Variable amplitude excitation
288

Variable cross section
73, 312, 556, 947, 1270, 1330,
1333, 1344, 1903, 2262, 2286,
2291, 2342

Variable mass
231

Variable material properties
740, 1128

Variational methods
926, 1036, 1250

Vehicle suspension systems
249

Vehicle-structure interaction
1078

Vehicle-terrain interaction
1815, 1822, 1823

Velocity admittance
1703

Vertical vibrations
585

Vibration absorbers (equipment)
2485

Vibration absorbers
43, 1564

Vibration absorption (equipment)
895, 1314, 1760, 2194

Abstract

Numbers: 1-192 193-444 445-652 653-864 865-1055 1056-1263 1264-1496 1497-1756 1757-2002 2003-2199 2200-2406 2407-2618

Volume 17

Issue: 1 2 3 4 5 6 7 8 9 10 11 12

Vibration analysis
87, 89, 152, 609, 610, 631, 1910,
1950, 2000

Vibration control
56, 197, 203, 265, 367, 459, 563,
865, 875, 1055, 1056, 1097, 1140,
1166, 1281, 1320, 1345, 1516,
1872, 1953, 2012, 2021, 2022,
2027, 2049, 2081, 2129, 2250,
2270, 2318, 2474, 2480, 2481,
2486, 2498, 2509, 2510, 2612

Vibration damping
122, 904, 1314, 1389, 1593

Vibration excitation
232, 724, 981, 1857

Vibration frequencies
1617

Vibration generation
596, 597

Vibration isolation
530, 897, 2067

Vibration isolators
696, 2244, 2507

Vibration measurements
396, 462, 632, 830, 1676, 1960,
2043, 2048, 2415, 2502, 2596, 325

Vibration meters
1236

Vibration prediction
684, 790, 1122, 2014

Vibration probes
2387

Vibration reduction
2224

Vibration response
76, 240, 873, 976, 1309, 1428

Vibration testing
2617

Vibration tests
406, 690, 818, 832, 1243, 1792,
2056, 2319, 2390

Vibration transducers
1415

Vibration transfer
1873

Vibrators (machinery)
1201, 1778

Vibrators
1182, 1183

Vibratory techniques
458, 864, 1496, 2028

Vibromotors
1184

Vibro-impact systems
847

Violins
1371, 1460

Viscoelastic core-containing
materials
2561

Viscoelastic damping
691, 986, 1392

Viscoelastic foundations
1892, 2407

Viscoelastic media
1802

Viscoelastic properties
348, 621, 909, 1298, 1338, 1730,
2134, 2245, 2266, 2278, 2507

Viscoplastic properties
1670

Abstract

Numbers: 1-192 193-444 445-682 683-864 865-1055 1056-1263 1264-1496 1497-1756 1757-2002 2003-2196 2200-2408 2407-2618

Volume 17

Issue: 1 2 3 4 5 6 7 8 9 10 11 12

Viscosity effects
1875, 2098, 2296, 2577

Viscous damping
208, 436, 989, 1060, 1153, 1168,
1257, 1393, 1506, 1952

Visco-elastic properties
2578

Vortex induced excitation
2248

Vortex shedding
71, 269, 1090, 1099, 1837, 2032,
2234, 2272, 2276, 2304, 2307,
2336, 2531

Vortex-induced vibration
304, 1033, 1124, 1871, 2269,
2270, 2271, 2315, 2367, 2368,
2372

- W -

Walls
97, 473, 481, 578, 761, 1179,
1640, 1641, 2343

Warping
725, 913, 1888, 1913, 2463

Water towers
2211

Water waves
2277, 2354

Water
954, 2115

Wave absorption
330, 693

Wave attenuation
340, 1351

Wave diffraction
384, 771, 1002, 1193, 1198, 1255,
1657, 1673, 1958, 2569

Wave energy
829

Wave forces
244, 303, 502, 567, 568, 645,
1805, 2228, 2277, 2392, 2562

Wave generation
84, 313, 923, 1381, 2392

Wave makers
2392

Wave propagation
91, 92, 98, 99, 102, 145, 348,
385, 386, 396, 435, 456, 555,
564, 622, 623, 624, 680, 735,
767, 810, 813, 815, 909, 914,
947, 963, 966, 984, 1047, 1157,
1158, 1169, 1189, 1199, 1328,
1365, 1379, 1384, 1484, 1485,
1486, 1655, 1656, 1672, 1673,
1722, 1798, 1906, 1923, 1927,
1952, 2036, 2113, 2114, 2119,
2126, 2146, 2147, 2241, 2242,
2260, 2340, 2341, 2347, 2351,
2353, 2564, 2568

Wave radiation
94, 342, 604, 656, 768, 771, 773,
1120, 1364, 1366, 1367, 1371,
1599, 1648, 1657, 1907, 1932,
1990, 2088, 2118, 2121, 2348

Wave reflection
347, 399, 956, 1171, 1671, 1674,
1886, 1943, 2341, 2352

Wave refraction
960, 965

Wave scattering
101, 329, 343, 387, 388, 438,
769, 770, 811, 812, 814, 959,
962, 964, 967, 968, 1194, 1198,
1366, 1613, 1672, 1675, 1725,
1926, 1981, 2040, 2116, 2120,
2146

Abstract

Numbers: 1-192 193-444 445-852 853-884 885-1085 1086-1283 1284-1486 1487-1786 1787-2002 2003-2198 2200-2408 2407-2818

Volume 17

Issue: 1 2 3 4 5 6 7 8 9 10 11 12

Wave transmission
93, 339, 598, 716, 950, 1674,
1886

Wavefront expansion method
2533

Waveguide analysis
1368, 1925

Wear
132, 634, 791, 807, 873, 1108,
2079, 2249, 2337

Weighted residual technique
472, 2467

Welded joints
61, 288, 289, 547, 548, 1326

Wheels
1867, 2072

Wheelsets
247, 464

Whipping phenomena
593, 594, 595, 943

Whirling
57, 58, 206, 871, 1066, 1070,
1071, 1072, 1073, 1279, 1507,
1547, 1579, 2407

Wilson method
2190

Wind forces
238

Wind tunnel testing
1090, 1117, 1264, 1301, 1476,
1477, 1678, 2005, 2468, 2598

Wind tunnel tests
407, 1080, 2470

Wind tunnels
1474, 1965, 1971

Wind turbines
267, 1135, 1284, 1765, 1872

Windows
30, 34, 950, 1352

Wind-induced excitation
114, 122, 338, 471, 488, 526,
551, 552, 661, 670, 692, 1080,
1081, 1082, 1084, 1085, 1086,
1087, 1088, 1089, 1091, 1093,
1094, 1095, 1097, 1098, 1099,
1100, 1117, 1135, 1167, 1205,
1221, 1296, 1353, 1519, 1520,
1523, 1601, 1805, 1872, 1953,
2032, 2115, 2196, 2210, 2212,
2362, 2370, 2372, 2466

Wind-induced vibrations
891

Wing stores
250, 250, 363, 1843

Winkler foundations
1525, 1885, 2279

Wire
1882

Wood
483, 1521

- Y -

Yaw angle
2307

- Z -

Zoom analysis method
2373

Abstract
Numbers: 1-192 193-444 445-652 653-884 885-1055 1056-1263 1264-1496 1497-1758 1759-2002 2003-2199 2200-2406 2407-2618

Volume 17

Issue:	1	2	3	4	5	6	7	8	9	10	11	12
--------	---	---	---	---	---	---	---	---	---	----	----	----

CALENDAR

JANUARY

28-30 **Reliability and Maintainability Symposium** [ASME] Las Vegas, NV (ASME)

FEBRUARY

3-6 **4th International Modal Analysis Conference** [Union College] Los Angeles, CA (Ms. Rae D'Amelio, Union College, Wells House, Schenectady, NY 12308 - (518) 370-6288)

MARCH

5-7 **Vibration Damping Workshop II** [Flight Dynamics Laboratory of the Air Force Wright Aeronautical Labs.] Las Vegas, NV (Mrs. Melissa Arrajj, Administrative Chairman, Martin Marietta Denver Aerospace, P.O. Box 179, Mail Stop M0486, Denver, CO 80201 - (303) 977-8721)

24-27 **Design Engineering Conference and Show** [ASME] Chicago, IL (ASME)

APRIL

8-11 **International Conference on Acoustics, Speech, and Signal Processing** [Acoustical Society of Japan, IEEE ASSP Society, and Institute of Electronics and Communication Engineers of Japan] Tokyo, Japan (Hiroya Fujisaki, EE Department, Faculty of Engineering, University of Tokyo, Bunkyo-ku, Tokyo 113, Japan)

13-16 **American Power Conference** [ASME] Chicago, IL (ASME)

29-1 **9th International Symposium on Ballistics** [Royal Armament Research and Development Establishment] RMCS, Shrivenham, Wiltshire, UK (Mr. N. Griffiths, OBE, Head/XT Group, RARDE, Fort Halstead, Sevenoaks, Kent TN14 7BP, England)

MAY

12-16 **Acoustical Society of America, Spring Meeting** [ASA] Cleveland, OH (ASA Hqs.)

JUNE

3-6 **Symposium and Exhibit on Noise Control** [Hungarian Optical, Acoustical, and Cinematographic Society; National Environmental Protection Authority of Hungary] Szeged, Hungary (Mrs. Ildiko Baba, OPAKFI, Anker koz 1, 1061 Budapest, Hungary)

4-6 **Machinery Vibration Monitoring and Analysis Meeting** [Vibration Institute] Las Vegas, NV (Dr. Ronald L. Eshleman, Director, The Vibration Institute, 101 W. 55th St., Suite 206, Clarendon Hills, IL 60514 - (312) 654-2254)

8-12 **Symposium on Dynamic Behavior of Composite Materials, Components and Structures** [Society for Experimental Mechanics] New Orleans, LA (R.F. Gibson, Mech. Engrg. Dept., University of Idaho, Moscow, ID 83843 - (208) 885-7432)

JULY

20-24 **International Computers in Engineering Conference and Exhibition** [ASME] Chicago, IL (ASME)

21-23 **INTER-NOISE 86** [Institute of Noise Control Engineering] Cambridge, MA (Professor Richard H. Lyon, Chairman, INTER-NOISE 86, INTER-NOISE 86 Secretariat, MIT Special Events Office, Room 7-111, Cambridge, MA 02139)

24-31 **12th International Congress on Acoustics**, Toronto, Canada (12th ICA Secretariat, P.O. Box 123, Station Q, Toronto, Ontario, Canada M4T 2L7)

SEPTEMBER

14-17 International Conference on Rotordynamics [IFTOMM and Japan Society of Mechanical Engineers] Tokyo, Japan (Japan Society of Mechanical Engineers, Sanshin Hokusei Bldg., 4-9, Yoyogi 2-chome, Shibuyak-ku, Tokyo, Japan)

22-25 World Congress on Computational Mechanics [International Association of Computational Mechanics] Austin, Texas (WCCM/TICOM, The University of Texas at Austin, Austin, TX 78712)

OCTOBER

5-8 Design Automation Conference [ASME] Columbus, OH (ASME)

5-8 Mechanisms Conference [ASME] Columbus, OH (ASME)

19-23 Power Generation Conference [ASME] Portland, OR (ASME)

20-22 Lubrication Conference [ASME] Pittsburgh, PA (ASME)

NOVEMBER

30-5 American Society of Mechanical Engineers, Winter Annual Meeting [ASME] San Francisco, CA (ASME)

**CALENDAR ACRONYM DEFINITIONS
AND ADDRESSES OF SOCIETY HEADQUARTERS**

AHS	American Helicopter Society 1325 18 St. N.W. Washington, D.C. 20036	IMEchE	Institution of Mechanical Engineers 1 Birdcage Walk, Westminster London SW1, UK
AIAA	American Institute of Aeronautics and Astronautics 1633 Broadway New York, NY 10019	IFTOMM	International Federation for Theory of Machines and Mechanisms U.S. Council for TMM c/o Univ. Mass., Dept. ME Amherst, MA 01002
ASA	Acoustical Society of America 335 E. 45th St. New York, NY 10017	INCE	Institute of Noise Control Engineering P.O. Box 3206, Arlington Branch Poughkeepsie, NY 12603
ASCE	American Society of Civil Engineers United Engineering Center 345 E. 47th St. New York, NY 10017	ISA	Instrument Society of America 67 Alexander Dr. Research Triangle Pk., NC 27709
ASLE	American Society of Lubrication Engineers 838 Busse Highway Park Ridge, IL 60068	SAE	Society of Automotive Engineers 400 Commonwealth Dr. Warrendale, PA 15096
ASME	American Society of Mechanical Engineers United Engineering Center 345 E. 47th St. New York, NY 10017	SBE	Society of Environmental Engineers Owles Hall, Buntingford, Hertz. SG9 9PL, England
ASTM	American Society for Testing and Materials 1916 Race St. Philadelphia, PA 19103	SESA	Society for Experimental Mechanics (formerly Society for Experimental Stress Analysis) 14 Fairfield Dr. Brookfield Center, CT 06805
ICF	International Congress on Fracture Tohoku University Sendai, Japan	SNAME	Society of Naval Architects and Marine Engineers 74 Trinity Pl. New York, NY 10006
IEEE	Institute of Electrical and Electronics Engineers United Engineering Center 345 E. 47th St. New York, NY 10017	SPE	Society of Petroleum Engineers 6200 N. Central Expressway Dallas, TX 75206
IES	Institute of Environmental Sciences 940 E. Northwest Highway Mt. Prospect, IL 60056	SVIC	Shock and Vibration Information Center Naval Research Laboratory Code 5804 Washington, D.C. 20375-5000

PUBLICATION POLICY

Unsolicited articles are accepted for publication in the **Shock and Vibration Digest**. Feature articles should be tutorials and/or reviews of areas of interest to shock and vibration engineers. Literature review articles should provide a subjective critique/summary of papers, patents, proceedings, and reports of a pertinent topic in the shock and vibration field. A literature review should stress important recent technology. Only pertinent literature should be cited. Illustrations are encouraged. Detailed mathematical derivations are discouraged; rather, simple formulas representing results should be used. When complex formulas cannot be avoided, a functional form should be used so that readers will understand the interaction between parameters and variables.

Manuscripts must be typed (double-spaced) and figures attached. It is strongly recommended that line figures be rendered in ink or heavy pencil and neatly labeled. Photographs must be unscreened glossy black and white prints. The format for references shown in Digest articles is to be followed.

Manuscripts must begin with a brief abstract, or summary. Only material referred to in the text should be included in the list of References at the end of the article. References should be cited in text by consecutive numbers in brackets, as in the following example:

Unfortunately, such information is often unreliable, particularly statistical data pertinent to a reliability assessment, as has been previously noted [1].

Critical and certain related excitations were first applied to the problem of assessing system reliability almost a decade ago [2]. Since then, the variations that have been developed and practical applications that have been explored [3-7] indicate . . .

The format and style for the list of References at the end of the article are as follows:

- each citation number as it appears in text (not in alphabetical order)
- last name of author/editor followed by initials or first name
- titles of articles within quotations, titles of books underlined
- abbreviated title of journal in which article was published (see Periodicals Scanned list in January, June, and December issues)
- volume, issue number, and pages for journals; publisher for books
- year of publication in parentheses

A sample reference list is given below.

1. Platzter, M.F., "Transonic Blade Flutter -- A Survey," Shock Vib. Dig., Z (7), pp 97-106 (July 1975).
2. Bisplinghoff, R.L., Ashley, H., and Halfman, R.L., Aeroelasticity, Addison-Wesley (1955).
3. Jones, W.P., (Ed.), "Manual on Aeroelasticity," Part II, Aerodynamic Aspects, Advisory Group Aeronaut. Res. Dev. (1962).

Articles for the Digest will be reviewed for technical content and edited for style and format. Before an article is submitted, the topic area should be cleared with the editors of the Digest. Literature review topics are assigned on a first come basis. Topics should be narrow and well-defined. Articles should be 3000 to 4000 words in length. For additional information on topics and editorial policies, please contact:

Milda Z. Tamulionis
Research Editor
Vibration Institute
101 W. 53th Street, Suite 206
Clarendon Hills, Illinois 60514