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RECENT SOVIET CONFERENCES ON AUTOMATIC CONTROL,  
COMPUTER ENGINEERING AND ELECTRICAL SIMULATION

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translation

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## FOREWORD

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RECENT SOVIET CONFERENCES ON AUTOMATIC CONTROL,  
COMPUTER ENGINEERING AND ELECTRICAL SIMULATION

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ALL-UNION CONFERENCE ON AUTOMATIC CONTROL AND  
METHODS OF ELECTRICAL MEASUREMENTS

/Pages 132-137/

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cal Institute

At the Automation and Electrometry Institute of the Siberian branch of the USSR Academy of Sciences in Novosibirsk an All-Union Conference on Automatic Control and Methods of Electrical Measurements took place from 29 September through 3 October 1959.

Representatives of 114 different organizations from 38 of our country's cities took part in the work of the conference. A broad range of problems was touched on at the conference, including digital computers, bridge methods of measurement, loaded mechanism deformation measurement, problems of the dynamics of instruments, new data units, new measurement designs, increasing the accuracy of apparatus and complex automation problems. The conference's work proceeded in two parallel sections: automatic monitoring and electrical measurement methods. The purpose of the conference was the exchange of experience and the coordination of scientific research work in the areas of automatic monitoring and methods of electrical measurement.

Candidate in Technical Sciences T. M. Aliyev (Scientific Research Design Institute for Complex Automation in the Oil and Chemical Industry, Sumgait, Azerbaijan SSR) presented a report entitled "The Automatic Coordinatograph" which set forth the design and structure of a coordinatograph which makes it possible to make a recording of two functionally related values presented in the form of electrical voltages. The developed coordinatograph is used in the oil industry for tele-dynamo measurement of wells.

Yu. V. Grachev and Z. B. Yel'yashevich (Azerbaijan Institute of Oil and Chemistry, Baku) delivered a report on "Automatic Monitoring of Well Parameters During Drilling and Exploitation." This report gives characteristics and parameters of telemeasuring channels over power cables connecting with buried electric motors with channels in the up to 100 kes band. The development of special inclinometers for automatic monitoring over an oil well trunkline when drilling with an electric drill and of telemeasuring devices for monitoring depth parameters of oil wells equipped with electric pumps. It was noted that for other methods of drilling -- turbine and rotor -- a reliable communications channel for telemeasurement and monitoring devices has not yet been discovered.

In his report "Use of Synchronized Detection to Measure Ultra-Low Frequency Non-Sinusoidal Voltage Vectors," P. I. Dekhterenko (USSR Academy of Sciences Electrotechnical Institute) spoke on the use of the synchronic detection principle to measure voltage vectors by the change of ultra-low frequencies within very broad limits (from 15 to 0.01 cycles and lower) where there is distortion in the form of the measured voltage curve because of non-linearity in the system and also where there is interference. Comparative analysis of the types of synchronic detectors from the point of view of their peculiarities during experimental determination of the amplitude-phase frequency characteristics of automatic control systems has shown that it is most convenient to use a mechanical synchronic detector. Analysis was made of the operation of a detector where there was interference using the method of A. A. Kharkevich which consists in the harmonic linearization of the synchronic detector of relay activity.

Corresponding member of the USSR Academy of Sciences K. B. Karandeleov, Candidate in Technical Sciences F. B. Grinevich, scientific workers V. P. Shul'ts and T. N. Mantush (Automation and Electrometry Institute of the SO [Siberian Branch] of the USSR Academy of Sciences, Novosibirsk) delivered a report entitled "Some Problems in the Automation of Capacitor Sorting". Due to the tremendous scale of production of capacitors for the radio technical and electrotechnical industry and the increased demands for their electrical parameters, the automation of sorting effects a considerable saving. The simplest technical solutions result where use is made of the theory of separate balancing of alternating current bridges. With comparatively low demands for accuracy in sorting designs must be used with an approximation of the curvilinear limits of the area of permissible values of capacitor parameters by the segments of the straight lines. A programming device for sorting capacitors can be constructed by fixing the limits of the ranges of permissible values and fixing the entire ranges of permissible values. Fixing the ranges and limits can be accomplished with the help of a combination auxiliary bridge and by coding on immovable discs.

V. I. Konstantinov (Scientific Research Design Institute for Complex Automation in the Oil and Chemical Industries, Sumgait) delivered a report entitled "An Automatic Gas Analyser to Determine the Concentration of Chlorine and Chlorine Gas Mixture on a Scale From 80 to 100%." The report gives the results of the development of an analyser for automatic uninterrupted qualitative analysis of chlorine gas mixtures for their chlorine content. The operational basis of the gas analyser is the property of chlorine to absorb ultraviolet radiation in the 365 angstrom range. The concentration of chlorine in a gas mixture is determined by the special photometric compensating optical system of the scheme. Its percentage of error does not exceed 0.5.

Candidate in Technical Sciences P. S. Kostichev from the NIPI, Nauchno-issledovatel'skiy Biokhimicheskiy Institut Pishchevoy Promshlennosti--Scientific Research Biochemical Institute of the Food Industry, Moscow, delivered several reports. A report entitled "Determining Moments of Torque in Rolling" gives measurements of the moment of torque expended to deform the metal and the moment expended to overcome the friction of the moving parts of the rolling mill at the moment of rolling by means of wire data units. The measurement of the moments of torque and the accumulation of experimental materials are extremely important in the design and operation of rolling-mills. Two other reports dealt with a new method of measuring flexible telescoping of rolling cylinders with the help of wire data units and also the measurement of the specific pressure of the metal on the rollers during rolling with the help of wire data units.

Candidates in Technical Sciences A. M. Melik-Shakhnazarov and I. L. Shayn (Azerbaijan Institute of Oil and Chemistry) presented a report entitled "Automatic Rectangular Crossbar Alternative Current Compensators and their use in Measuring Complex Resistances," which set forth the principles of measurement of vector magnitudes for electrical and magnetic values, complex resistances and various nonelectrical values in automatic monitoring circuits by means of a rectangular crossbar compensator. The question arises as to the expediency of industrial manufacture of alternating current general purpose compensators.

The reports on automatic devices with digital readings as the most promising trend in the development of electrical measurement technology aroused special interest.

Delivering a report entitled "Electrical measurement digital devices, Candidate in Technical Sciences V. M. Shlyandin (Polytechnical Institute, Penza) dealt with the general principles of construction and classification of digital devices. Several structural designs were considered, as well as units for comparing electromechanical digital devices. A broad survey was made of the control unit for electromechanical digital devices, the digital reading system, the switching of the limits of measurement and polarity and the automatic marking current assembly.

Candidates in Technical Sciences V. V. Kovaleskaya and B. Z. Belen'kiy (USSR Academy of Sciences Institute of Electromechanics, Leningrad) stated in a report entitled "Digital Phasometer with Direct Graduation" that the study of discrete methods of measurement has shown the possibility of constructing an instrument utilizing the method of converting phase shift to a number of impulses with direct graduation of the scale in electrical degrees. The utilization in the instrument of the method of measuring the mean value of the angle of phase shift during several periods, a method based on duplex conversion of the measured value, permits the exclusion of the influence on the results of the measurement of the frequency of the voltages studied and of the frequency of the calibrating generator. The digital phasometer was built with electronic tubes and non-heating thyatron.

A report was given by Lecturer N. V. Kirianaki (Polytechnical Institute, L'vov) entitled "Multilimit automatic digital volt-ampere-meter". This volt-ampere-meter satisfies to a considerable degree the following operating conditions: automatic selection and switching of the polarity of the measured e.m.f.; automatic selection and switching of the limits of measurement; the provision of a maximum number of digital symbols; automatic processing of the reading; the opportunity of showing readings visually and recording them. The instrument permits the measurement of constant voltages within the limits from 10 millivolts to 100 volts and currents from 1 milliamperes to 10 amperes. Line impedance of the voltmeter is 100 kilohms. Voltage drop on the ampere meter is 100 millivolts.

Three reports on computing instruments were presented by workers of the Novocherkassk Polytechnical Institute. In a report entitled "The Automatic Direct Current Compensator with Digital Reading" Lecturer Ye. I. Tenyakov noted that in the department of automatic and measurement apparatus a compensator had been designed and built with digital readings to measure direct voltage from 0.1 to 1,000 volts with an error of 0.05% and a speed of 20 measurements per minute.

The basis for the compensating unit was the principle of "over-compensation" of the measured voltage with return to "undercompensation." The working current is established automatically in the compensating circuit with the help of a tracking system with a relay-electronic circuit for controlling the reversible motor.

Lecturer D. I. Malov in a report entitled "Some Problems in the Study of Digital Ohmmeters" considered the dynamics of the process of equilibration of a high-speed digital ohmmeter. The instrument is considered as a relay system for cyclic regulation of resistance. The comparative resistance is what is regulated. An electronic booster served as the sensitive element of the system at the outlet of which a polarized relay is switched on. The digital ohmmeter being studied has the following characteristics: the band for measuring resistance

respectively equals  $0.001 \frac{1}{10}$  ohms; mean error -- 0.05-0.1%; output dispersed on the resistance being measured --  $0.001 \frac{1}{1}$  watts; time of one measurement 3 seconds.

Graduate student V. A. Ivantsov in a report entitled "An Electronic Measuring Element for Automatic Instruments" described an electronic measuring element with the following parameters: sensitivity  $\frac{1}{10}$  microvolts, input resistance about 100 kilohms; stability with overloads 100,000 times; high stability; time of operation about 15 microseconds. The element is based on the principle of direct current amplification on the modulation circuit and alternating current amplification on the demodulation circuit. The measuring element can be used in accurate automatic digital bridges and potentiometers.

A group of workers from the Institute of Automatics and Electrometry of the SO of the USSR Academy of Sciences, Novosibirsk), Candidate in Technical Sciences M. P. Tsapenko, Engineers A. A. Aref'yev, A. N. Kasperovich and N. A. Khmelevskiy and others, presented a report entitled "An Electronic Digital Multiple-Projection Millivoltmeter." The instrument is intended for work with wire loaded mechanism deformation data units and thermocouples and consists of a high-speed two-way switch, comparison devices, a compensation-voltage level shaper and a zero element. The result is recorded on a register from the electroluminescent elements and on photographic paper.

The report of Engineer S. G. Prokopyuk (Oil-reprocessing Plant, Ufa) entitled "The Development of Quality Instruments Under KIP-shop Conditions" was devoted to an automatic register of the viscosity of heavy oil products of the rotary type (viscograph type VA-56) and to the automatic register of the content of salts in prepared oil.

Graduate student B. I. Puchkin (D. I. Mendeleev VNIIM  $\sqrt{\text{Vsesoyuzn'iy Nauchno-issledovatel'skiy Institut Metrologii imeni D. I. Mendeleev--All-Union Scientific Research Institute of Metrology imeni D. I. Mendeleev}}$ , Leningrad) in a report entitled "Some Problems in Research and Improvement of Pasted Tension Data Units" noted the need for standardization of pasted tension data units and also the widening of opportunities to use tension data units in autocontrol and regulation systems.

In a report entitled "Industrial Use of Gas Analysers and Concentrate Measurers," Engineer V. I. Roskin (Oil Refining Plant, Ufa) showed the need for replacing laboratory analysis by automatic analysis due to the laboriousness and length of time involved and the possibility of automating the control of the process. Noting some deficiencies in existing automatic analysis instruments, he reported on the concentration meter developed by them to measure great concentrations of aluminum sulphate.

Candidate In Technical Sciences B. S. Sinitsyn (Electromechanical Institute, Novosibirsk) gave a report entitled "Dynamic Errors of Automatic Monitoring Systems." With strict observation of the operation of automatic monitoring systems one must take into account the undetermined character of changes in the value measured and of disturbing effects and consider them as chance functions of time. Reducing dynamic error is accomplished by improving the characteristics of individual sections, by using high-speed elements and by selecting correcting sections. In prospect is the prediction of future magnitudes of input values, a prediction based not only on knowledge of them in the past but also on measurements of their magnitudes in other areas. The autocontrol system with such correction must have several inputs. Consequently, the problems of determining the best operator of a system are complicated by the task of optimal selection of input values.

In a report entitled "Use of Matrix Grids to Perform Mathematical Operations," Candidate in Technical Sciences M. P. Tsapenko and Engineer O. V. Ulin (Institute of Automation and Electrometry of the SO of the USSR Academy of Sciences, Novosibirsk) made a comparison of the methods of mathematical processing of information and reported on the use of matrix grids for addition, subtraction, multiplication and division of numerical values with a set error and also the use of matrix grids for statistical processing of experimental data.

Candidate in Technical Sciences G. S. Chernorutskiy (Polytechnical Institute, Chelyabinsk) delivered two papers: "A System for Measuring the Torsion Angle of a Rotating Roller" and "A System for Measuring Low Displacement Speeds." The first paper set forth the construction features in a system for measuring the torsion angle and the results of experiments with it. The second paper dealt with a compensation circuit for measuring the speed of feed of a drilling instrument of an experimental machine used for drilling blast oil wells. It gives the construction features and the results of experiments with it.

A great number of reports were presented at the section on electrical measurement methods.

Three reports by Candidate in Technical Sciences M. A. Bykov (VNII Vsesoyuzn'iy Nauchno-issledovatel'skiy Instrumental'nyy Institut--All-Union Instrument Scientific Research Institute, of the Committee on Standards, Measurements, and Measuring Instruments attached to the SM Council of Ministers of the USSR, Moscow) were devoted to the problems of developing a system for precise measurement of the angles of losses of capacitors and of constant time with multi-ohm resistances and the development of apparatus for checking alternating current bridges by the angle of losses and the development of standard measures of inductance and capacitance of large magnitudes -- up to 100 henrys and up to 10,000 microfarads.



Senior Instructor D. A. Bezukladnikov (Ural'sk Polytechnical Institute, Sverdlovsk) reported on a method for measuring large direct currents and on solutions reached in the design of apparatus to measure direct current up to 75,000 amperes.

Senior Engineer V. N. Goncharskiy (Institute of Machine Operation and Automation of the Academy of Sciences of the Ukrainian SSR, L'vov) in a report entitled "Some Results of Aero-Electro-Prospecting with the use of an Infinitely Long Cable (BDK)" stressed the prospects for this method and the need to revise circuits for measuring and generating apparatus.

In a report entitled "A Conductance Meter in the Frequency Band from 1 to 250 meg on a Double T-Circuit," Candidate in Technical Sciences A. L. Prokhol'skiy (NGIMIT /Novosibirsk Gosudarstvenniy Institut Meteorologii--Novosibirsk State Institute of Meteorology/) reported the preliminary results of research on a meter for the active and reactive components of full conductance and methods of reducing measurement error.

Senior Engineer G. M. Gushchina (D. I. Mendeleev VNIIM, Leningrad) gave a report entitled "Standard Measures for the Angle of Losses, their Attestation and use in Radio Broadcasting Frequencies Band."

A report entitled "Precise measurement of alternate current power" was given by Engineer A. M. Ilyukovich (VNII of the Committee of Standards, Measures and Measuring Devices attached to the SM of the USSR, Moscow). A new method is being used to compensate for temperature error by bypassing the coil of the sequential circuit by a circuit containing a semiconductor thermoresistance. Compensation for the frequency error was tried first. The compensation circuit consists of a capacitance bypassing the coil of the parallel circuit and an inductance choke coil switched on in series with this junction. A standard class 0.2 meter was successfully built.

Candidate in Technical Sciences Z. G. Kaganov (Textile Institute, Ivanovo) in a report entitled "Measurement of Wave Parameters of Electrical Machine Coils" gave a short survey of methods of impulse measurement of wave parameters and methods of measuring complex resistances of coils. It was noted that it was possible to replace pulse measurements by high-frequency ones. Selection of the optimal frequency band is being settled.

Engineer N. I. Kalashnikov (Institute of Machine Operation and Automation of the Academy of Sciences of the USSR, L'vov) in a report entitled "On the Selection and Disposition of Receiving Apparatus for Aero-Electro-Prospecting with the use of an Infinitely Long Cable on the MI-4 Helicopter" noted the basic factors determining the occurrence

of interference in receiving apparatus: electromagnetic pick-up from the electrical equipment in the helicopter, vibrations and atmospheric interference. In measuring fields with comparatively low frequencies the measuring apparatus must be set up in an outlet gondola only. With comparatively high frequencies the measuring apparatus can be placed in the middle part of the tail girder of the helicopter.

Corresponding member of the USSR Academy of Sciences K. B. Karandeyev and Candidate in Technical Sciences L. Ya. Milyuk (Institute of Automatics and Electrometry of the SO of the Academy of Sciences of the USSR, Novosibirsk) presented a report entitled "Measuring Apparatus for Aero-Electro-Prospecting." In research, artificially stimulated electromagnetic fields were used. Information on geological formation is obtained by apparatus set up in the aircraft or helicopter. The measured parameters may be the amplitude, phase and the square components of the vertical or horizontal constituents of the magnetic field. The measuring apparatus must have a high resistance to interference.

In the report of Candidate in Technical Sciences V. N. Karpenko (Institute of Electrical Engineering of the USSR Academy of Sciences, Kiev) entitled "Computing alternating current bridges for magnetic measurement at higher frequencies" it is noted that the basis for computing bridges at higher frequencies is the method of unified parameters proposed by A. M. Volkov. Analysis of measurement error has established that at higher frequencies only a circuit with parallel hookup of the elements in adjacent complex arms can be used.

Candidates in Technical Sciences P. P. Kemeshis (Polytechnical Institute, Kaunas) gave a report entitled "Some Problems in the Theory of an Electrodynamical Vector-measurement System." A simple system for determining the correlation coefficient for two periodic functions is the independent activation electrodynamic instrument.

A report entitled "The Thermistor Bridge Used with an Alternating Current Voltage Declination Indicator" was delivered by Candidates in Technical Sciences I. F. Klistorin and N. V. Degtyarnik (Institute of Automation and Electrometry of the SO of AS of the USSR, Novosibirsk). The method and results of an investigation of a thermistor bridge as a measuring unit for construction of a precision alternating current stabiliser were set forth. The plan was given for a bridge in which the effect of the temperature of the surrounding substance is reduced to 0.1 — 0.2% per 10 centigrade in the temperature range from 15°C. to 35°C.

Candidate in Technical Sciences I. N. Krotkov (D. I. Mendeleev VNIIM, Leningrad) presented a report entitled "Methods for Precise Measurement of the Components of Full Conductance of the Elements of Line Electrical Circuits." A survey and analysis of domestic and foreign instruments and assemblies to measure resistance, induction, capacity and quality was given. It was noted that the new modifications of instruments developed by the VNIIM make it possible to carry out measurements in the radio broadcasting frequency band with an error of from 0.1 / 1%.

In a report entitled "Frequency Errors of Rectifier System Instruments" Engineer Ye. I. Kurilov (Institute of Machine Engineering and Automation of the AS of the Ukrainian SSR, L'vov) noted the need to calculate the change in the commutation of angles in rectifiers because of reactive elements. The general formulas for determining frequency error with low reactance of the circuit were cited.

Engineer A. V. Lashas (Polytechnical Institute, Kaunas) in a report entitled "Some Methods of Damping High-speed Chart-recording Instruments" noted that an effective method of damping recording devices with low sensitivity and an electronic booster is the introduction of positive current feedback in the recording instrument.

Professor M. I. Levin (Energetics Institute, Moscow) presented a report entitled "On the Properties of Some Phase-sensitive Circuits," in which he considered phase-sensitive measurement circuits with a sequential parallel circuit. He showed that with the given parameters of the circuit the deviation of the measurement indicator is only slightly dependent on the change in the additional resistance. The phase-sensitive circuits considered can be constructed both with semi-conductors and with mechanical rectifiers.

The report of Professor M. I. Levin and Graduate Student R. M. Demidova (Institute of Energetics, Moscow) entitled "The Problem of Using Alternating Current Potentiometers with Higher Frequencies" considered the characteristics of the compensation method at higher frequencies, the effect of intercontour capacitive currents on the accuracy of measurements and also the elimination of factors which decrease the accuracy of the instrument.

Candidate in Technical Sciences N. V. Levitskaya (VNII of the Committee on Standards, Measurements and Measuring Instruments attached to the SM of the USSR, Moscow) presented a report entitled "A Method for Determining Phase Errors and Mutual Inductance of Mutual Inductance Coils and Magazines at Higher Frequencies." Proposed was a method of measuring phase error and mutual inductance of standard coils at frequencies from 400 to 1,000 cycles. The principle of the method is a comparison of mutual inductance with some phase error with a standard capacitor having a known slight angle of loss.

A. M. Lyubarskaya and N. I. Tyurin (VNII of the Committee of Standards, Measurements and Measuring Instruments attached to the SM of the USSR, Moscow) gave a report entitled "On Government Experiments with Electrical Measurement Instruments." It was noted that a very definite trend in the development of the instrument making industry is an increase in accuracy, a broadening of the limits of measurement, the broadening of the frequency band, the reduction of sizes and the development of special instruments.

In a report entitled "Alternating Voltage Indicators" Candidate in Technical Sciences L. Ya. Mizyuk (Institute of Automatics and Electrometry of the SO of the AS of the USSR, Novosibirsk) noted that no decisive work has been done yet on alternate voltage indicators. Great opportunities have been disclosed by indicators using electronic and semiconductor elements.

Candidates in Technical Sciences L. Ya. Mizyuk and L. D. Gik (Institute of Automatics and Electrometry of the SO of the AS of the USSR, Novosibirsk) presented a report entitled "The Transmission Band of the Direct Current Booster with Conversion." With half-wave modulation and synchronous detection, undistorted amplification is possible up to a frequency equal to the half-frequency of the modulating function. The use of full-wave modulation and full-wave synchronous detection opens up wide possibilities for utilizing boosters with conversion.

Candidate in Technical Sciences L. Ya. Mizyuk, Candidate in Technical Sciences G. A. Shtamberger and Engineer N. A. Zavilenskaya (Institute of Automatics and Electrometry of the SO of the AS of the USSR, Novosibirsk) presented a report entitled "A Quasi-balanced Bridge for Measuring Complex Resistances." The instrument includes a bridge circuit and a zero indicator. The operating frequency equals 1,000 cycles.

Candidates in Technical Sciences L. Ya. Mizyuk and V. I. Gol'dgefter (Institute of Automatics and Electrometry of the SO of the AS of the USSR, Novosibirsk) presented a report entitled "Autocompensated Alternating Current Circuits". To measure a weak signal where there is a high level of background interference use of a selective booster is proposed with a synchronous phase filter at the output and a deep reverse feedback.

Candidate in Technical Sciences V. S. Popov (Institute of Electrical Engineering of the AS of the USSR, Leningrad) presented a report entitled "Statistical Converters for Precise Measurement of Capacities." It considered methods of precise measurement of capacities through comparison by special thermo-electric converters. The thermal effect proportional to the measured power is compared with

the analogous thermal effect produced by a known "standard" output. Judgement of the equivalence is made on the basis of temperature. A wattmeter which has been developed satisfies the requirements for a class 1.5 instrument.

The report by Candidate in Technical Sciences L. A. Sinit'skiy (Institution of Machine Engineering and Automatics of the AS of the USSR, L'vov) entitled "Errors of Direct Current Transformers" cites formulas to determine the error of direct current transformers based on load resistance.

The report of Engineer V. P. Skuridin (Ural'sk Polytechnical Institute, Sverdlovsk) entitled "Compensating Methods of Measuring Sinusoidal Signal Phase Difference" presented a short survey of existing methods of measuring phase difference and considered ways to increase the accuracy of these measurements.

Professor R. R. Kharchenko, Doctor of Technical Sciences, and Engineer S. G. Golub' (Energetics Institute, Moscow) presented a report entitled "A Highly Accurate Multichannel Galvanometric Booster." The report dealt with methods and experiments with boosters on Type GB miniature galvanometers with photo converters and a negative feedback circuit. The accuracy of the amplitude characteristic is  $\pm 0.2\%$ . Nominal values of voltages are at input 20 megavolts and at output 10 volts.

The report of V. P. Shigorin (D. I. Mendeleev VNIIM, Leningrad) entitled "A Bridge for Comparison of Standard and Test Resistances Within a Range of from 0.001 to 100,000 Ohms" considers a bridge comparator: The comparison of resistances was made by the substitution and transposition methods. The bridge comparator is placed in a thermostatic bath.

Candidate in Technical Sciences A. Ya. Shramkov (Polytechnical Institute, L'vov) presented a report entitled "Some Problems in the Theory of Directly Evaluating Electro-measurement Instruments" in which detailed examination was made of the problem of error in instruments with variable scales and also the computation method for determining the mechanical characteristics of electromeasurement instruments.

Speaking in a discussion, the conference participants noted that along with great achievements in automatic monitoring and methods of electrical measurement there is poor coordination of scientific research work and insufficient exchange of experience. One of the reasons for this situation is the lack of a specialized journal. It was

noted also that in many areas of automatic monitoring and measurement, for instance in the production of automatic computing instruments, we are lagging behind foreign industry.

The conference adopted a detailed resolution which noted the sizeable increase in the number of projects in the area of automatic monitoring and electrical measurement methods and the great importance of the discussion. In the interests of eliminating deficiencies in the exchange of experience and the coordination of scientific research work a decision was taken to start a journal entitled Automatic Monitoring to be published by the SO of the Academy of Sciences of the USSR.

ALL-UNION SEMINAR ON CONTACTLESS MAGNETIC ELEMENTS FOR  
AUTOMATION, TELEMECHANICS AND COMPUTER TECHNOLOGY

[Pages 137-138]

I. I. Pekker

From 13 through 16 August of this year an All-Union Seminar on Contactless Magnetic Elements for Automation, Telemechanics and Computer Technology was held in Moscow. The conference was called by the Institute of Automatics and Telemechanics of the Academy of Sciences of the USSR. The seminar was opened by Professor B. S. Sotskov, Doctor of Technical Sciences. Representatives of various organizations at the seminar gave more than 30 reports.

The first day of the seminar was devoted mainly to a consideration of designs using magnetic boosters which operate with semi-conductor triodes and diodes. Similar combinations permit a successful solution to many very complicated problems in automatic control.

Professor M. A. Rozenblat, Doctor of Technical Sciences, reported on work in building magnetic transistor boosters.

Lecturer I. B. Negnivitskiy, Candidate in Technical Sciences, and Candidate in Technical Sciences R. A. Lipman reported on an original design which they had developed which combined magnetic and semi-conductor elements.

Professor A. M. Bamdas, D.T.S., made a survey of designs for transformers regulated by the excitation of a shunt and developed by V. A. Suchkov, S. V. Shapiro and himself.

N. I. Chicherin, V. G. Lemov and A. I. Chizhov reported on their work with highspeed magnetic boosters.

I. A. Petrusenko gave a report on the use of rectifiers in circuits with magnetic boosters.

The second day of the seminar was devoted to magnetic elements used in the computer field. There were ten reports on this subject.

The report of Ye. K. Yuferova was devoted to integrating elements which use ferrites and operate on the principle of pulse summation. Reports by A. Ya. Artyukhin, A. Ye. Oborenko, M. I. Petrukhin and others were devoted to various ferromagnetic elements used in computing machines.

The third day of the seminar opened with a report by N. P. Vasil'yeva C.T.S., devoted to a consideration of logical designs using magnetic and transistor elements and intended for automatic control circuits. A group of reports on the research and design of elements with a rectangular loop was presented by Yu. M. Shamaev, V. F. Belyavskiy, V. L. Dyatlov and A. I. Pirogov. Ya. G. Koblena [a male] spoke on the use of magnetic elements in dial telephone technology. V. I. Zhulin reported on the magnetic repeater with high-ohm input. The reports of V. I. Vizun and V. V. Kobelev dealt with instruments for experimental research on elements with a rectangular loop.

At the concluding session V. S. Volodin reported on a magnetic semiconductor voltage stabilizer developed by M. A. Rozenblat and himself which provides high quality stabilization.

Lecturer I. I. Pekker, C.T.S., reported on throttles controlled by excitation with the help of permanent magnets which make it possible to build direct and alternating current measuring elements. Comrade Protopopov gave a report on a regulating system based on magnetic boosters. Reports were also given by A. K. Romanov and I. V. Prangishvili.



INTER-UNIVERSITY SCIENTIFIC AND TECHNICAL CONFERENCE  
ON ELECTRICAL MODEL OPERATION FOR PROBLEMS IN  
STRUCTURAL MECHANICS, STRENGTH OF MATERIALS  
AND THE THEORY OF ELASTICITY

[Pages 138-141]

K. K. Keropyan

From 21 through 25 September the first inter-university scientific and technical conference on electrical model operation for problems in structural mechanics, the strength of materials and the theory of elasticity was held at the Rostov Construction Engineering Institute.

Sixty-six delegates took part in the conference, representing various scientific and technical establishments, institutes and design organizations which deal with problems of electrical model operation. The work of the conference was handled in three sections: the theory of elasticity section, the rod system statics section and the rod system dynamics section.

At the plenary session two reports were heard. Professor G. Ye. Pukhov in a report entitled "The Theory and Principles of General-Purpose Modeling grids from Ohmic Resistances" gave the results of theoretical and experimental research on electro-modeling grids of the second order, carried out at the Computing Center of the Academy of Sciences of the Ukrainian SSR under Pukhov's direction.

Professor K. K. Keropyan reported the results of the scientific work of the Special Problems Laboratory for Electrical Modeling of the Rostov Construction Engineering Institute, from the time it was opened, in the development and introduction of modeling methods in construction mechanics.

The reports of Doctor of Technical Sciences A. G. Ugodchikov on the subject "Use of Conformal Conversion Electro-modeling to Solve the Flat Problem of the Theory of Elasticity for One and Two-contact Areas" were heard with considerable interest and attention as were the reports of his followers, Lecturer V. K. Perekhvatov and Graduate Student Ye. Ye. Antonov (Gor'kov Construction Engineering Institute) which were devoted to the calculation of voltages in bank-stands and to the solution of the problem of distortion of prismatic rods of orthotropic material using the conformal conversion electrical modeling method developed by A. G. Ugodchikov.

Engineer Ye. A. Yerokhin (Computing Machine Scientific Research Institute) in a report entitled "Use of Electric Modeling Devices to Solve Marginal Problems" talked about methods (the experimental and the search method) for solving marginal problems in the theory of elasticity with the help of electrical modeling assemblies.

O. V. Tezoni, C.T.S. (Novocherkassk Polytechnical Institute) in a report entitled "The Electrical Integrator for Solving the Marginal Problems of Neumann (Neyman) and Dirikhle on the band" reported on an assembly and the principles of operation of an integrator developed by him to solve the problem which had been raised.

L. V. Nitsetskiy, C.T.S. (Riga Polytechnical Institute) in a report entitled "Electric Modeling of Three-dimensional Contact Problems in the Theory of Elasticity" considered the possibility of using special electrointegrators to solve marginal problems in the theory of elasticity (pressure of a rigid punch on a resilient half-space and others).

Senior Instructor A. L. Kvitko (Kiev Polytechnical Institute) in a report entitled "Use of Electrical Models to Solve the Axial Symmetry Problem in the Theory of Resiliency and the Problem of Distortion of Variable Diameter Rollers" discussed a method developed by him to solve this problem with the help of a grid integrator. The author gave a new method of using models for the axial symmetry problem in the theory of resiliency, a method which permits investigation of the condition of cylinders under pressure with an arbitrary surface load and can be extended to rotors, which makes it very important for turbine construction.

Graduate student A. I. Medovikov (Moscow Construction Engineering Institute) in a report entitled "A Solution of the Flat Complex Problem in the Theory of Resiliency by Using Electric Models for the Functional of Voltages" discussed a method developed by him for solving this problem by means of electric models.

Senior Engineer of Hydroproject (Moscow) A. K. Kuznetsova in her report told of her experience in investigating the condition under pressure of construction elements used in an integrator. She gave a detailed analysis of the method of studying the condition under pressure of thin plates and of construction elements working under the conditions of the flat problem.

Engineer V. P. Zinenko (Computing Center of the Academy of Sciences of the Ukrainian SSR) in the first part of his report entitled "Use of Continuously Running Machines to Solve some Marginal Problems and Possibilities for MPT-9 Modeling Apparatus for Finding Frequencies and Proper Oscillation Forms of Systems" gave the results of the research of Candidate in Physico-Metallurgical Sciences V. N. Ostapenko (who was unable to attend the conference on account of illness) on the use of MPT-9 machines to solve the marginal problems analytically. The second part considered a method of finding frequencies and proper oscillation forms of resilient systems with the help of MPT-9 electric modeling machines.

The section on the theory of resiliency noted how up-to-date and advanced the subjects of all the reports were and how much work had been done by the authors on the development and introduction of electric models in structural mechanics.

The rod system statics section heard seventeen reports and two papers.

Professor G. Ye. Pukhov (Computer Center of the AS of the USSR) in a report on the subject "A Model of Algebraic Equations of the Electric Grid Type of the Second Order" considered the working principle of a model and the method of deciding problems on it. The design of the model for solving a system of algebraic equations which was exhibited by Pukhov is of considerable interest and deserves to be developed further since it covers a great range of problems in structural mechanics which can be solved on it.

Doctor of Physico-Metallurgical Sciences I. I. Vorovich (Rostov State University) in a report on the subject "Accuracy of Electric Modeling of Rod Systems" gave the mathematical reason for the size of errors arising where electric models are used with rod systems. Vorovich first gave the mathematical reason for the size of the errors where electric models are used with rod systems, which is important for the planning and construction of new models.

O. V. Il'yenko, C.T.S. (Ryazan' Radiotechnical Institute) in a report entitled "Modeling of some Rod Systems with Electrical Circuits Composed of Four-pole Networks" clarified the great possibilities for the design of flat and spatial problems by the electric model method. When models are carefully made the error does not exceed 1%.

Professor K. K. Keropyan in a report entitled "A Solution to Canonical Equations in Structural Mechanics with the Help of Designs Composed of Four-pole Networks" showed how a solution could be reached for the problem in question using existing models for the design of rod systems composed of four-pole networks which makes it possible to expand the number of problems which can be solved with these models.

V. V. Kozlyakov, C.T.S. (Leningrad Shipbuilding Institute) in a paper entitled "Computing Deformities of Displacement and Instability in a Cross-Section of Rods in Designing Rod Systems by the use of Electric Models" showed that in a design analog of a bent rod deformity of displacement and instability of the cross section can be taken into account, which is of practical significance in planning construction designs.

Engineer V. M. Samus' (Computer Center of the Academy of Sciences of the Ukrainian SSR) in a report entitled "Use of Electric Models of Thin-walled Casings with V. V. Vlasov's Variation Method" reported on a method which he had developed of using electric models for this problem. Differential equations of the general variation method of V. V. Vlasov applicable to casings were transformed by the author of the report to a system of naturally different equations on an electrical circuit consisting of ohmic resistances.

The reports of Engineers V. N. Usynin, V. M. Samus', V. A. Lapy, A. G. Levin and G. V. Karandakov (Computer Center of the AS of the Ukrainian SSR) considered various cases where an electric model grid of the second order was used to solve different systems of lineal algebraic and differential equations on the basis of principles set forth in Professor G. Ye. Pukhov's report.

Professor G. Ye. Pukhov's report on the theory and principles of construction of a new electric model was heard with great interest. The model was developed by the Computing Center of the AS of the Ukrainian SSR for the design of rod systems. Subsequent reports by Engineers Ye. A. Proskurin, G. V. Karandakov, V. I. Usynin, V. V. Vasil'yev and A. V. Konstantinova were devoted to a description of the assembly of separate units of this model and its use in solving various problems in the statics of rod systems. In particular, Engineer Ye. A. Proskurin demonstrated how to solve with this model systems of trinomial equations with Jakobi's matrix. The section noted the high efficiency of the new model and recommended it for mass production.

Graduate Student Ya. D. Gil'man (Rostov Construction Engineering Institute) in a report entitled "Design of U-shaped Frames with Resilient Seals by Using Electric Models" cited the results of research with the EMSS-1 model on various flat one-stage frames with displaced and undisplaced units and with resilient seals on the stands. He showed the effectiveness of using models of this type to design frames with resilient seal on the stands.

Lecturer O. V. Luzhin (Kuybyshev Military Engineering Academy), in a paper on the subject "An Electrical Model of a Closed Profile Thin-walled Rod", on the basis of the three-pole displacement design proposed by Professor K. K. Keropyan as an analog for the open and closed profile thin-walled rod gave formulas which determine the parameters of the displacement design for a closed thin-walled profile.

In summing up the results the section noted that the reports presented covered three areas: 1) Theory and practice of using models for problems in rod system statics with the help of electric grids of the second order; 2) Theory and practice of using models for problems in statics with the help of analogous designs; 3) Problems of accuracy in the use of electric models for rod systems. The section noted that the

broad range of problems in structural mechanics which can be solved by the use of electrical grids of the second order proposed by Professor G. Ye. Pukhov make them particularly attractive to builders. However, the collective of the Computing Center of the AS of the Ukrainian SSR must devote serious attention to the solution of problems connected with the automation of the processes of balancing such grids.

The section on the dynamics of rod systems heard four reports.

Professor K. K. Keropyan gave a report on the subject "Determining Oscillation Frequencies of Rod Systems with the Help of New Models." He pointed out that the new model, developed by Professor G. Ye. Pukhov, can also be used according to this method for dynamic calculations.

Lecturer P. M. Chegolin (Ryazan' Radiotechnical Institute) in a report entitled "Use of Electric Models of Free Oscillations of Thin-walled Rods" showed the possibility of modeling the free oscillations of an open profile thin-walled rod with two axes of symmetry with the help of a three-pole analog circuit.

The report of Lecturer A. N. Ter-Mkrtychan (sic) (Tula Mechanical Institute) entitled "Determination of Critical Loads for a Compressed and Curved and Secured Thin-walled Rod" gave a solution on an MN-7 electro-modeling machine of the system of differential equations describing the balance of the compressed-curved and loaded two-T rod. Research carried out by the author shows that by the electro-modeling method one can determine the critical loads for a great number of problems. A drawback of this method is the impossibility of getting the total dependence of critical loads on the conditions of the problem.

The report of Engineer V. V. Vasil'yev (Computer Center of the AS of the Ukrainian SSR) on the subject "Determination of Frequencies and Forms of their Own Oscillations of Girders on an Electro-modeling Grid of the Second Order" gives a method for solving problems for statically determinable girders.

The participants in the conference passed a resolution which stated in particular:

- 1) The reports given and the exchange of opinions which took place showed that the theory of electro-modeling problems in structural mechanics and the theories of resiliency and the strength of materials are being successfully developed in our country.

- 2) The opening of the first special problems laboratory in the Soviet Union for electro-modeling of problems in the structural mechanics of the strength of materials and the theory of resiliency by the USSR Ministry of Higher Education at the Rostov Construction

Engineering Institute is an important contribution to the development and introduction of methods of electro-modeling in structural mechanics. The laboratory has done considerable work on the development of the theory of principles of electro-modeling and now has at its disposal considerable equipment which makes it possible to carry out teaching and scientific research and also furnish assistance to industry.

3) The conference notes the considerable amount of work in the theory of electro-modeling, in problems of structural mechanics and the theory of elasticity, performed by the collectives of the Computer Center of the AS of the Ukrainian SSR and the Kiev Institute of the Civil Air Fleet under the direction of Professor G. Ye. Pukhov, Doctor of Technical Sciences.

4) The conference notes the important work being done at the Taganrog Radiotechnical Institute and the Gor'kiy Construction Engineering Institute in electro-modeling of problems in the theory of elasticity under the direction of A. G. Ugodchikov, D.T.S, and also the work done at the Riga and Kiev Polytechnical Institutes, the Moscow Construction Engineering Institute, the Leningrad Shipbuilding Institute, the Tula Mechanical Institute, the Scientific Research Department of Hydroproject and the Scientific Research Institute for Computing Machine Construction.

5) The conference notes the high efficiency of the new model developed by the Computer Center of the AS of the USSR and considers it necessary that this model be put into mass production.

6) The conference considers it necessary to place before the ministry the problem of organizing industrial production, for training and research purposes, of electrical models which have been developed.

7) The conference makes the following recommendations:

a) that further experimental work on the design of new electric models be concentrated in Kiev at the Computer Center of the AS of the Ukrainian SSR and that construction of an experimental plant in Kiev be expedited;

b) that the special problem laboratory of RISI /Rostovskiy-na-Donu Inzhenerno Stroitel'nyy Institut--Rostov-na-Donu Engineering and Construction Institute/ be required to develop methods for work with electrical models and to acquaint other universities with them and also to bring forward recommendations for building new models.

8) The conference considers it expedient to concentrate in the journals Izvestiya Vysshikh Uchebnykh Zavedeniy-Elektromekhanika -- /Electrical Engineering/ and Stroitel'stvo i Arkhitektura /Construction and Architecture/, the publication of material on the use of electrical models for problems in structural mechanics, the theory of resiliency and the strength of materials.

9) The conference requests The Ministry of Advanced and Intermediate Special Education of the USSR to introduce in engineering schools in the structural mechanics course a class in the use of electric models for structural engineering problems.

10) The conference considers it necessary to review existing programs for electrical engineering courses at technical schools, giving serious attention in the new program to the design of electrical circuits and to electro-measuring technology.

11) The conference considers it necessary to enlist the scientific forces of engineering schools for work on and preparation of those problems in structural engineering, the theory of resilience and strength of materials for which models must be made.

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