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UDC 534.79

Comparative Evaluation of Objective and Subjective Methods of Estimating Actual Sound Signal Levels

18600132a Moscow TEKHNIKA KINO I TELEVIDENIYA in Russian No 6, Jun 88 pp 11-13

[Article by I. K. Nechayev, Leningrad Institute of Motion-Picture Engineers]

[Abstract] Differences between objective and subjective estimates of actual sound signal levels have been established in an experiment involving audio experts. As the subjective measure of sound signal level served loudness of a signal in terms of purely physiological perception, variances due to psychological factors having been carefully eliminated. Four typical programs covering a wide range of sound timber were taped for use in the test: 1) solo instrumental (piano) music: "Prelude to a Bashkir Song," 2) symphonic music: "St John's Passion" by J. S. Bach, 3) vocal music: "You, My First Love..." by M. Rakov, 4) theatrical music: "Express" play by V. Ignatyev. While listening to these programs in a sound-proof chamber, the audio expert continuously adjusted the intensity of a 1000 Hz reference tone to apparently the same loudness. At the same time, objective measurements were made with a sound level recording instrument and a sound spectrum analyzer. Figures 1; tables 1; references 3: 1 Russian, 2 Western.

UDC 621.391.254

Efficiency of Redundant Encoding Under Conditions of Interference Lumped in Time Intervals

18600118a Kiev IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: RADIOELEKTRONIKA in Russian Vol 31 No 5, May 88 (manuscript received after revision 27 Apr 87) pp 18-24

[Article by V. S. Gutin and Yu. A. Stankevich]

[Abstract] Transmission of binary data is considered with a scrambler between encoder and modulator on the sender side which pseudorandomly changes the order of symbols, their original order being restored by an unscrambler on the receiver side. Redundant encoding of such data is evaluated analytically and numerically for error probability and efficiency, assuming transmission in orthogonal equal-energy packages and optimal noncoherent demodulation under conditions of Gaussian interference lumped in time intervals. Calculations based on five Bose-Chaudhuri-Hocquenghem codes and ideal scrambling indicate that redundant encoding tends to compensate the detrimental effect of lumped Gaussian interference on the fidelity of transmission. Figures 5; tables 2; references 7: 3 Russian, 4 Western (3 in Russian translation).

UDC 621.391.26

Identification of Communication Channel Parameters Under Conditions of Approximately Gaussian Additive Interference

18600118b Kiev IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: RADIOELEKTRONIKA in Russian Vol 31, No 5, May 88 (manuscript received 10 Nov 86) pp 24-31

[Article by A. L. Marimont and N. I. Naumenko

[Abstract] Optimal identification of communication channel parameters in the presence of Gaussian noise and various forms of additive interference is analyzed from the standpoint of robustness in accordance with information theory of identification. Limits on parameter estimation errors are established for linear digital audio-frequency channels with correction of intersymbol errors. Absolutely optimum algorithms of estimating channel and corrector parameters are shown to be difficult to implement, inasmuch as they require inversion of the A-matrix. While the Kalman algorithm is not quite adequate, even though it is much more practical, the method of least squares is shown to be altogether incorrect under conditions of approximately Gaussian Interference. A Robust algorithm of parameter identification in class G is constructed and subsequently accelerated, its gist being to find the noise distribution density which is optimum in class G. Figures 4; tables 1; references 6: 4 Russian, 2 Western.

UDC 621.396.621.33

Interference Immunity of Tracking Radio Receivers in Broadband Analog Radio Telephone Communication Systems

18600118c Kiev IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: RADIOELEKTRONIKA in Russian Vol 31 No 5, May 88 (manuscript received after revision 10 Nov 86) pp 32-36

[Article by I. S. Nekrasov]

[Abstract] The performance of tracking radio receivers operating in broadband analog radio telephone communication systems is analyzed for immunity to interference lumped in frequency bands, such an interference causing additional frequency modulation and thus fast variations of the carrier. A receiver is considered which consists of a radio-frequency amplifier with tracking filters in the input stage, a mixer, a tuned amplifier, a detector, a "floating frequency" heterodyne, a synchronizer, and output stages. All interference bands are assumed to be comparable in width with the spectrum of the interference-free useful signal. Calculations on this basis indicate that in a receiver with a given radio-frequency bandwidth the useful gain over lumped interference increases with increasing carrier frequency deviation and with increasing interference power, the receiver efficiency becoming maximum at the maximum allowable interference level at the receiver input determined by the minimum desirable signal-to-interference ration at the receiver output. Figures 1; references: 4 Russian.

UDC 621.394.62:621.391.037.372

Basic Characteristics of Discrete Signals with Phase-and-Frequency Modulation

18600118d Kiev IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: RADIOELEKTRONIKA in Russian Vol 31 No 5, May 88 (manuscript received after revision 20 Apr 87) pp 36-41

[Article by M. A. Ivanov, I. I. Svatovskiy, and I. A. Yakovlev]

[Abstract] The characteristics of discrete signals with synchronous and cophasal phase-and-frequency modulation are analyzed, of special interest being narrow-band signals in this class. An array of equal-power optimum signals is synthesized which, according to the criterion of maximum aposteriori probability, will be most immune to interference during reception in the presence of additive white Gaussian noise. Such a signal, describable by the second-order mixed term of a double Volterra series and thus being the product of a phase-modulated one and a frequency modulated one, has a resultant phase equal to the sum of their phases and an envelope equal to the product of their envelopes. These characteristics of narrow-band optimally phase-and-frequency modulated signals are desirable for very efficient transmission of discrete messages and for use in various types of digital communication systems. References 9: 8 Russian, 1 Western (in Russian translation).

UDC 621.396

Invariant Detection of Signal with Rejection of Narrow-Band Interference

18600118e Kiev IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: RADIOELEKTRONIKA in Russian Vol 31 No 5, May 88 (manuscript received after revision 13 Apr 87) pp 53-55

[Article by V. I. Sirotiniy]

[Abstract] Detection of a quasi-harmonic signal appearing with additive normal noise of unknown power and with quasi-harmonic interference of high intensity is considered, a typical problem of panoramic radar or sonar, such signals being usually processed with the aid of fast Fourier transformation. This problem is solved here by the method of invariants, which reduces it to detection of a non-coherent signal submerged in noise only. The largest invariant having been identified, the resulting detection rule is almost independent of the interference and characterized by a false-alarm probability independent of the noise power. Figures 3; references 3: 1 Russian, 2 Western (1 in Russian translation).

UDC 621.394.62(088.8)

Analysis of Distortions in Frequency-Modulated Radio Signals During Synchronous Detection

18600118f Kiev IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: RADIOELEKTRONIKA in Russian Vol 31 No 5, May 88 (manuscript received 5 FEb 87) pp 55-57

[Article by V. V. Degtyarev and V. Yu. Lokustov]

[Abstract] Following description of a synchronous demodulator for detection of frequency-modulated radio signals by digital techniques, a simpler demodulator is proposed which in addition to the resolver contains a phase detector and a frequency-to-voltage converter for analysis of signal distortions. The detector determines the sign of instantaneous frequency deviations and the converter estimates their absolute magnitude. The operation of this demodulator is demonstrated on detection of a modulating double-sideband signal with a finite spectrum by sampling. Calculations reveal that distortions become excessive when the modulation index is smaller than 2 and become negligible when it is larger than 4. Figures 3; references 6: 5 Russian, 1 Western.

UDC 621.373.82

Acoustooptic Scanator on Para-Tellurite Crystal with Piezoelectric-Wedge Transducer

18600118g Kiev IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: RADIOELEKTRONIKA in Russian Vol 31 No 5, May 88 (manuscript received after revision 23 Apr 87) pp 79-81

[Article by V. A. Glazkov, E. N. Yeloyev, V. V. Rybina, M. A. Talalayev, and N. K. Chalikidi]

[Abstract] A diffracting acoustooptic scanator for control of light beams is described which consists of a paratellurite crystal with a 163 deg yz-cut $LiNbO_3$ wedge covering a part of one face in the capacity of piezoelectric transducer and an equilateral angle plate around the farthest opposite corner acting as absorber. The transducer is designed for maximum bandwidth and for optimum matching with the high-frequency oscillator. Figures 2; references 5: 3 Russian, 2 Western.

Device for Tuning Radio Station to 5.6 GHz

18600129b Moscow RADIO in Russian No 5, May 88 pp 24-26

[Article by V. Prokofyev, Moscow]

[Abstract] A device for tuning a radio station to 5.6 GHz is described which operates as a generator of a frequency-modulated signal with a wide range of power regulation by means of an attenuator and as spectrum analyzer with power level indication. In the generator mode a narrow-band filter converts a periodically frequency-modulated signal into a signal with a noise-like spectrum approximately as wide as the filter passband. In the analyzer mode the transistor of the master oscillator operates in the autodyne mode. Both assembly and alignment procedures are outlined, following a detailed description of essential components and their layout. Figures 4; references: 2 Russian.

UDC 654.197:006

Television Broadcasting Systems and Standards

18600132e Moscow TEKHNIKA KINO I TELEVIDENIYA in Russian No 6, Jun 88 pp 30-34

[Article by D. P. Brilliantov, All-Union Scientific Research Institute of Television and Radio Broadcasting]

[Abstract] The basic characteristics of National Color TV, PAL, SECAM, and European Satellite TV broadcasting system and the basic parameters of corresponding standards are overviewed in comprehensive tabular form which indicates video and audio carrier frequencies as well as frequency bands assigned to each country, also the types of power supply, the modulation methods, and the polarization modes used worldwide. Figures 2; tables 9.

UDC 621.397.611 VTR

Countermeasures Preventing Fatigue of Videotape-Recorder Operators

18600132f Moscow TEKHNIKA KINO I TELEVIDENIYA in Russian No 6, Jun 88 pp 48-52

[Article by A. I. Kempi and A. Ye. Chubenko, Leningrad Scientific Research Institute of Labor Hygiene and Occupational Diseases]

[Abstract] Following a review and analysis of the fatigue problem affecting operators of videotape recorders in TV centers, seven recommendations are made aimed at alleviating this problem: 1) abatement of noise in the control room, 2) curtailment of individual working hours by introduction of rest periods and rotation of three crews over the 12 h long morning and evening shifts, 3) improvement of lighting in the control room by use of day-light lamps with adequate (200 lx minimum) illumination levels and by minimization of glare, 4) improvement of ventilation in the control room, 5) regulation of the crew size, 6) avoidance of overstress and illness, 7) improvement of work place and equipment layout. Figures 1; references: 14 Russian.

Transverter and Antenna for 5.6 GHz Channel

18600150a Moscow RADIO in Russian No 6, Jun 88 pp 17-20

[Article by V. Chernyshev]

[Abstract] A transverter for the 5.6 GHZ amateur radio channel is described which operates between a 144 MHz heterodyne and a 144 MHz transceiver. Its high-frequency stage consists of a frequency quintupler followed by a mixer and a matching circuit which couples the mixer to the antenna. A frequency quintupler is coupled to the heterodyne through a frequency tripler and a matching circuit. The mixer is coupled to the transceiver through a matching circuit and an amplifier or an attenuator between two switches for operation in the receiver mode or the transmitter mode respectively, three relays also being provided for operation. Active components are built with transistors and semiconductor diodes. All transverter components are mounted on a 180x340 mm^2 large panel under a 40 mm high cover, both made of 4 mm thick Duralumin sheet and the entire enclosure moisture-proofed. A special alignment and tuning procedure has been devised for ensuring optimum performance. The antenna is a parabolic reflector 67 cm in diameter and 9.6 cm deep, with a 29 cm focal length and a 120 deg aperture. Its radiation pattern is 6.5 deg wide and its gain is 28 dB, with a not higher than 1.5 standing-wave ratio. Figures 8; references: 3 Russian.

Video Cassette Recorder Elektronika VM-12

18600150b Moscow RADIO in Russian No 6, Jun 88 pp 43-47

[Article by S. Stepygin]

[Abstract] The two automatic controls in the Elektronika VM-12 video cassette recorder are described, one for the set of rotary heads and one for the drive shaft. Both are high-precision controls with phasing of the respective shafts relative to corresponding reference signals. Both are designed for operation not only in the basic "record" and "playback" modes but also for "fast scan," "slow scan," "stop recording," "stop playback," "continue recording," "short reverse," "forward rewind," and "backward rewind." Each consists of two signal shapers, a multivibrator as buffer oscillator, a speed sensor with amplifier, a speed regulator, a position sensor with amplifier, an electronic commutator, a reversing relay with switch, a frequency divider, and a power amplifier. All components are built with transistors as active elements and on integrated-circuit chips. Figures 4.

Miniature VHF Receiver

18600150c Moscow RADIO in Russian No 6, Jun 88 pp 49-52

[Article by S. Demin]

[Abstract] A miniature VHF superheterodyne radio receiver with fewer tank circuits than in a conventional one is described, its construction having been made simpler and alignment made easier by use of a piezoceramic filter and a series K174UR3 special integrated microcircuit in its i-f channel. All components are built with transistors as active elements and are mounted on a

1.5 mm thick printed-circuit board made of glass-Textolite. This assembly, together with the power supply and the telescopic antenna, fits into any housing designed with polystyrene. A special alignment and tuning procedure needs to be followed for ensuring satisfactory operation. Figures.3

Industry of German Democratic Republic Exhibiting in Moscow

18600150d Moscow RADIO in Russian No 6, Jun 88 p 57

[Article by staff of GDR's Trade Commission in USSR]

[Abstract] Products representing scientific and technical developments in the GDR are scheduled to be shown at the 1988 Exhibition of Achievements In USSR National Economy, 16 September to 9 October in Moscow. One part of the GDR's exhibit will be devoted to microelectronics and to applications of this technology in industry, specifically in flexible production systems and in computer-aided design. It is noteworthy that the number of robots operating in the industrial complex of the GDR has been increased during the year 1987 to 14,700 to a total of 73,000.

Functional Content of Series K155 Integrated Microcircuits and Their Series SN74 Equivalents

18600150e Moscow RADIO in Russian No 6, Jun 88 pp 59-60

[Article by V. Kulachko]

[Abstract] Integrated microcircuits of series K155 are the most widely used and most readily available ones for digital radio equipment. Their closest foreign functional equivalents are Texas Instruments series SN74 integrated microcircuits. Among the 101 series K155 chips, 89 are functionally interchangeable with series SN74 chips. Tables 1; references: 6 Russian

UDC 621.397.454.004.14

Storability of Video-Sound Recordings on Modern Magnetic Tapes

18600157a Moscow TEKHNIKA KINO I TELEVIDENIYA in Russian No 7, Jul 88 pp 18-21

[Article by V. A. Ustinov, USSR Scientific Research Center of Technical Documentation, and Yu. V. Shepelev, Television Engineering Center imeni October Semicentennial]

[Abstract] An experimental study was made at both the USSR Scientific Research Center of Technical Documentation and the Television Engineering Center concerning the storage life of video-sound recordings on modern magnetic tapes. A method of accelerated life estimation has been devised which involves artificial aging of the polymer substrate material and then mathematically calculating its life expectancy under real conditions on the basis of changes in its key physical properties. Three different tapes were artificially aged in a Tabai (Japanese) environmental chamber with precise temperature and humidity control at 75-85-90 deg C with 11.5 pct absolute humidity at each temperature for 24-200-400-1000 h. They were subsequently tested mechanically in an Instron 1122 universal machine with a PID-3 straing gauge for tensile strength, yield strength, percentage elongation under a 30 N load, residual elongation after load removal, and modulus of elasticity, also electrically with a conductance bridge and a teraohmmeter for surface resistance. An evaluation of the data and their correlation with amplitude-frequency characteristics of a composite test signal as well as with the performance parameters of both video and sound channels indicates that non-destructive electrical measurements suffice for estimation of the storage life. The thus estimated storage life on all three tapes is at lease 25 years, the video channel remaining more stable on T4412-50 tape produced in the USSR than on Scotch 400 tape produced in the United States and on V-16-64 tape produced in Japan. Tables 4; references: 5 Russian.

UDC 621.397.2.037.372

Device for Switching Digital Video Signals

18600157b Moscow TEKHNIKA KINO I TELEVIDENIYA in Russian No 7, Jul 87 pp 30-31

[Article by A. V. Vasilyev, Kirovograd Radio Products Manufacturing Plant]

[Abstract] A device for switching digital video signals in a 24x4 field has been developed and designed for production. It consists of two independent sets of three switches with separate power supply and control circuit for each set. All three switches of each set are connected in parallel to a signal receiver on the input side, a seventh switch alone being also connected to one of the receivers. The input signals correspond to ECL level and are encoded in nine bits, one of them carrying a 27 MHz clock signal. The switches process these signals at TTL level, which lowers the power requirement to 1 KW maximum and decreases the number of internal connections but requires conversion in the receivers. The switching capacity of the device is 216 Mbit/s per each of the two inputs. Figures 2.

UDC 621.397.611 video recording + 681.84:006

Conference of I.E.C.'s Technical Committee on Video and Sound Recording

18600157c Moscow TEKHNIKA KINO I TELEVIDENIYA in Russian No 7, Jul 88 pp 36-37

[Article by A. V. Goncharov, All-Union Scientific Research Institute of Television and Radio Broadcasting]

[Abstract] The IEC's Technical Committee No 60 on Tape Recording held a conference in Beijing/China which lasted from 28 September to 3 October 1987. In that conference participated representatives of 83 national committees from 13 countries, including the USSR, as well as representatives of other interested organizations and of leading equipment manufacturers. The conference dealt with reports of working groups GR7, GR5, GR3 on standardization. The topics included standardization of equipment for magnetic recording of television programs, especially of news reports recorded with separate analog signals, also for separate recording of luminance and chrominance signals, with standardization of measurement and tuning methods, with standardization of VHS and ED-Beta home equipment, and with introduction of DASH and Prodigi digital sound recording formats.

Automatic Monitoring of Locomotive Radio Stations in 'Transport'

18600130a Moscow AVTOMATIKA TELEMEKHANIKA I SVYAZ in Russian No 6, Jun 88 pp 11-13

[Article by Yu. V. Vavanov, chief, Department of Information Transmission, All-Union Scientific Research Institute of Railroad Automation, Yu. I. Klebanskiy, chief, Radio Communications Laboratory, O. S. Andrushko, chief designer, and B. N. Sorokin, master designer]

[Abstract] The automatic railroad traffic control system "Transport" includes three sets of measuring equipment KIS-ASV for monitoring locomotive radio stations, which operate in metric and hectametric wave bands, or in decimetric and hectametric wave bands, or in decimetric and metric wave bands. Monitoring involves two procedures: internal TEST 1 mode for checking the communication line. Both procedures have been automated for execution from a control board with appropriate starter push buttons and with a display panel showing the necessary information. Figures 4.

UDC 621.396.962

Accuracy Requirements for Estimating Carrier Motion Parameters in Signal Processing by Aerospace-Borne Radar with Synthesized Aperture
18600118i Kiev IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: RADIOELEKTRONIKA in Russian Vol 31 No 5, May 88 (manuscript received after revision 1 Jun 87) pp 93-95

[Article by A. R. Teterin and V. G. Kobernichenko]

[Abstract] A radar with synthesized aperture mounted on a moving aerospace-borne carrier and tracking a moving target is considered, its transient response when tracking a solitary point target being used as the basis for a determination of the necessary accuracy with which its own position as well as velocity and acceleration along an arbitrary trajectory must be estimated in the course of target signal processing. Both resolution and dynamic range of the image on the radar screen are taken into account, the law of Doppler phase variation being defined in terms of a norm. An analysis of the data discretization process indicates that the necessary accuracy cannot be determined for each parameter of radar carrier motion alone but only compositely for the entire set of its parameters. Figures 1; references 4: 3 Russian, 1 Western.

UDC 621.396.67.01

Correction of Side Lobes in Radiation Pattern of Aerospace-Borne
18600134a Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 33 No 6, Jun 88 (manuscript received 23 Apr 86) pp 1155-1161

[Article by V. P. Yakovlev]

[Abstract] A problem of remote sounding with a probe at high altitude is considered, namely suppression of interference affecting the side lobes in its radiation pattern. Space filtration is proposed, this method being much more effective in the case of a widely varying useful signal and two-dimensional filtration being adequate when the probe is sufficiently distant for its radiating surface to be regarded as a plane one. Formation of an output signal by such a probe is analyzed on this basis. A linear filter with a finiter with a finite spectrum is then synthesized for a digital data transmission channel, following a Fourier transformation of the filter response function required, typically, for dimensionally equalizing the fields of view of multifrequency or scanning receiver antennas. Figures 2; references: 5 Russian.

UDC 621.396.967.01

Angle Noise in Direction Finders
18600134b Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 33 No 6, Jun 88 (manuscript received 25 Apr 86) pp 1161-1168

[Article by R. V. Ostrovityanov and A. A. Monakov]

[Abstract] Estimation of angular coordinates of a target by a direction finder in the presence of angle noise is considered, estimates based on intensity-weighting of multichannel readings or time-weighting of individual readings shown to be identical to maximum-likelihood estimates based on linear regression. The algorithm of estimation by weighting is tested analytically for efficiency in the case of statistically coupled orthogonally polarized two channels and for decrement of efficiency in the discrete-sampling mode, also for dependence of its efficiency on the length of observation time in the case of mixed channel and time weighting over the correlation period, in the case of channel weighting and time averaging over the correlation period, and in the case of channel weighting and averaging by filtration. Figures 3; references 6: 5 Russian, 1 Western.

UDC 621.396.967.01

Decomposition and Analysis of Fluctuating Radar Targets in Antenna Space
18600134c Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 33 No 6, Jun 88 (manuscript received 15 Dec 86) pp 1186-1191

[Article by L. A. Zhivotovskiy]

[Abstract] Decomposition of a random scattering matrix such as that of a fluctuating radar target into three noncoherent components in the antenna aperture is shown, the target being represented by a random vector in the antenna space and target space basis. The proposed method of decomposition facilitates not only identification of a target but also analysis of its polarization characteristics and determination of the polarization correlation of target pairs. The author thanks D. B. Kanareykin and V. A. Polyanskiy for formulating and discussing the problem. Tables 1; references 5: 2 Russian, 3 Western (1 in Russian translation).

UDC 621.382.22

Experimental Study of Longitudinal-Mode Shallow Bulk Acoustic Waves
18600134h Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 33 No 6, Jun 88 (manuscript received 13 May 86) pp 1290-1294

[Article by A. M. Zaslavskiy, V. N. Posadskiy, and E. A. Semenov]

[Abstract] An experimental study of quasi-longitudinal-mode shallow bulk acoustic waves (usually considered a parasite effect) has yielded their characteristics most essential for the design of competitive SBAW-L acoustoelectronic devices. The experiments were performed with an ST-cut quartz crystal serving as soundguide between two interdigital transducers, the latter oriented parallel to the X-axis of the crystal. Excitation of parasitic modes and particularly the shear mode of shallow bulk acoustic waves was easily suppressed by a thin layer of sound absorbing material such as KhV-784 varnish on the crystal surface. Attenuation of longitudinal-mode shallow bulk acoustic waves in such a soundguide was only somewhat reduced by metallization of its surface with an aluminum film, only by 1.5-2 dB over the 200-800 MHz frequency range with an aluminum film of any thickness within the 50-300 nm range (the

velocity of longitudinal waves being 6.3 km/s in aluminum and 5.75 km/s in quartz). For effectively reducing the attenuation ought to be considered a film of metal characterized by a lower velocity of longitudinal waves or a quartz cut with minimum diffraction in the sagittal plane. Measurements were also made for determining the temperature characteristics of these waves in an ST (parallel to X)-cut quartz crystal, the temperature dependence of the relative frequency drift having yielded a temperature coefficient of delay equal to approximately 17.10^{-6}/deg over the -60/(70) deg C range and thus close to the theoretically calculated one. The feasibility of using longitudinal-mode shallow bulk acoustic waves in microwave devices and their advantages over shear-mode shallow bulk acoustic waves were demonstrated on a delay line consisting of two interdigital transducers 325 wavelengths apart, each having 140 pin pairs with a period of 0.0043 mm, and a soundguide with metal coating of a thickness 100 times smaller than the wavelength corresponding to a center frequency of 1337 MHz. Figures 3; references 7: 6 Russian, 1 Western.

UDC 537.874.33

Dielectric Cylinders with Continuous Variation of Refractive Index

18600134i Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 33 No 6, Jun 88 (manuscript received 29 Sep 86) pp 1313-1316

[Article by A. A. Vorontsov and S. L. Mirovitskaya]

[Abstract] The problem of diffractions and scattering of plane electromagnetic waves by graded-index optical fibers is solved numerically by replacement of such a fiber with a stepped-index dielectric cylinder as mathematical model. The validity of this method depends on the number of layers into which the cylinder has been subdivided and on the cross-section geometry of the generally nonhomogeneous optical fiber. Calculations including a convergence and accuracy analysis indicate the necessary and sufficient minimum number of layers, when the dependence of the diffraction pattern and particularly the angular coordinates of its minimum on the number of layers in the stepped-index model fiber has been stabilized. Figures 3; references: 3 Russian.

Some Problems in Biomedical Electronics

18600145a Moscow RADIOTEKHNIKA in Russian No 5, May 88 pp 3-4

[Article by Academician Yuriy Vasilyevich Gulyayev, professor, director, Institute of Radio Engineering and Electronics, USSR Academy of Sciences, chairman, Department of Semiconductor Electronics, Moscow Institute of Engineering Physics]

[Abstract] One of the most important contributions which electronics has recently made to developments in medicine is computer-aided tomography using x-rays, ultrasound, nuclear-magnetic resonance, gamma quanta, SPECT (with special substances injected into the blood), positron emission, or by other means. A major problem in practical implementation of this technique is the tremendously high cost of equipment capable of measuring infrared thermal, radiothermal, and acoustic emission from the human body or any other living organism, also its near-infrared and optical chemoluminescence as well as both its electric and magnetic fields, the characteristics of these emissions and fields being direct or indirect indicators of physiological and biochemical activity. A no less important contribution of electronics are prosthetic devices for monitoring and regulating physiological and biochemical activity, typical examples being the pacemaker and artificial blood-analyzing and insulin-synthesizing Langerhans islets in the pancreas. Another trend in biomedical radioelectronics is development of weak-signal physiotherapy with biofeedback in the real time by such methods as vibratory or contactless thermal massage, acupuncture or acupressure, laser or microwave irradiation.

UDC 621.396.6.001.2:681.3

Sensitivity of Electronic Tracking Systems Synthesized According to Local Optimization Criterion

18600145b Moscow RADIOTEKHNIKA in Russian No 5, May 88 (manuscript received 20 Jun 87) pp 9-12

[Article by V. I. Merkulov]

[Abstract] Synthesis of electronic tracking systems in accordance with M. V. Maksimov's local optimization criterion rather than the more problematic Letov-Kalman terminal optimization criterion is considered, the control algorithm for such tracking systems being somewhat less energy-efficient but much simpler in that the minimizable functional does not contain the integrand component which represents instantaneous tracking errors. An economical algorithm is constructed for accurately estimating the sensitivity of such a tracking system to variation of all its generalized parameters, the sensitivity of that functional serving as reference. This algorithm is constructed without expanding the state vector of controllable (tracked) coordinates. The sensitivity of a tracking system estimated according to this algorithm, is found to depend largely on the absolute magnitudes of the system's generalized parameters and on the values of the controllable coordinates, especially on the cost of tracking precision and the cost of control signal energy as well as on the control matrix. References 7: 5 Russian, 2 Western (in Russian translation).

UDC 621.371.39.012.11

Design of Optimum Impedance Transformers

18600145c Moscow RADIOTEKHNIKA in Russian No 5, May 88 (manuscript received 15 Jul 87) pp 24-26

[Article by V. F. Zhestkov and N. B. Shevchenko]

[Abstract] A method of designing impedance transformers is outlined, no quantitative method of optimizing their parameters being available and present design being based essentially on qualitative criteria. Such a transformer is assumed to be connected between two segments of a regular transmission line, sufficiently far from irregular components, and to have negligible intrinsic losses. The input impedances to this transformer Z(a) on the generator

side and Z(b) on the load side are related according to the relations Z(b) equal to jCZ(a)/[Z(a) plus jD]. Calculations aided by the circle diagram show that impedance measurement through such a transformer can be correct only when the two parameters s equal to n/c-D/ and t equal to C/D have their optimum values s_O and t_O (n- positive number whose reciprocal is equal to the absolute magnitude of the normalized impedance corresponding to one of the two fixed points of the circle diagram). Any other pair of s and t values, each parameter being independently variable from zero to infinity, may yield a large resultant measurement error and even an error larger than that of direct impedance measurement. Figures 2; references: 1 Russian.

UDC 621.376.33

Frequency Detector Built on Digital Delay Line

18600145e Moscow RADIOTEKHNIKA in Russian No 5, May 88 pp 40-41

[Article by V. G. Ivanova; annotation of article No 1233-sv deposited at Central Scientific and Technical Institute 'Informsvyaz']

[Abstract] A digital frequency detector is synthesized on the basis of a digital delay line having an odd number of segments, each segment ensuring a delay by one signal quantization step and the line being tapped twice: behind the first segment and before the last one. The detection algorithm is designed to yield the coefficients of two harmonics, second and third, of the output signal when the frequency of the input signal varies sinusoidally. The detector, not highly linear but software-economical, can serve as discriminator in automatic frequency-lock frequency control systems and particularly in those for frequency-keyed signals. Figures 1; tables 1; references: 1 Russian.

UDC 621.391

Algorithms of Processing Multivariate Signals

18600145f Moscow RADIOTEKHNIKA in Russian No 5, May 88 pp 42-52

[Article by V. V. Ginzburg]

[Abstract] A universal engineering theory of signals is outlined which generalizes the concept of distance between signals, distinct from signal deviation, and extends to synthesis of mutivariate signals for many classes of communication channels. Signal distance is a non-negative quantity, just as signal deviation, also a symmetric one and in a channel without memory an additive one. In a discrete symmetric channel both signal distance and signal deviation coincide with the Hamming distance. In a Poisson channel the distance between two signals is equal to the square of the difference between their square roots. Synthesis of multivariate signals is considered along with synthesis of their demodulator, a maximum-likelihood demodulator being regarded as the optimum and thus ideal one from the standpoint of minimum error probability but a real demodulator being also considered and required to satisfy the stability criterion. Stability is defined here as the largest radius of identical spheres fitting within the space of multivariate readings. The computer time for interference immunity analysis by numerical simulation is shortened appreciably with the stability and thus the maximum weight of signal distortion allowable for correct demodulator decision is known. References 26: 16 Russian, 1 Polish (in Russian translation), 1 Hungarian (in Russian translation), 8 Western (5 in Russian translation).

UDC 621.396:621.371

Measurement of Radio Signals from Vega-1 and Vega-2 Space Stations During Probing of Envelope of Halley's Comet

18600145g Moscow RADIOTEKHNIKA in Russian No 5, May 88 (manuscript received 10 Jun 87) pp 56-59

[Article by V. V. Seleznev, V. Ye. Andreyev, A. L. Gavrik, and Ye. P. Molotov]

[Abstract] The envelope of Halley's comet was probed with radio waves from Vega-1 and Vega-2 space stations during their flights in 1986. Radio signals returning from the comet were recorded and measured by two different methods so as to ensure higher reliability and confidence level. The first method involved conversion of decimetric-wave and centimetric-wave signals prior to their storage on magnetic tape within a narrow frequency band only 2 kHz wide and subsequent processing by an SM-4 minicomputer with a CAMAC-305 crate. The second method involved measurements in real time and processing with equipment consisting of two correlators, one for decimetric-wave signals and one for centimetric-wave signals, a microcomputer with one corrector and three storages, an indicator with a cathode-ray tube, and an SM-4 minicomputer with a CAMAC-305 crate. Each correlator consisted of an analog-to-digital converter, a control encoder, a multiplier, and a summator. A synthesizer of heterodyne readings served as reference oscillator. Data obtained on 6 March 1986 and on 9 March 1986 by this two-frequency radio probing with 32 cm and 5 cm waves indicate that this method is highly efficient and adequately accurate. Figures 5; references: 2 Russian.

UDC 621.391

Detection of Noncoherent Radar Signals Submerged in Gaussian Interference of Unknown Power

18600145h Moscow RADIOTEKHNIKA in Russian No 5, May 88 (manuscript received 16 Dec 87) pp 62-65

[Article by Yu. V. Sopelnik]

[Abstract] Detection of noncoherent radar signals appearing with Gaussian interference of apriori unknown power or dispersion is analyzed, assuming statistically independent samples used for estimation of the interference power on the basis of classified adaptive sampling. Group fluctuations of such a signal are taken into account, the signal assumed to contain L independent groups of N simultaneously fluctuating components. The detection characteristics, namely threshold output signal-to-interference ratio and cost in energy due to lack of apriori information about the interference power, are found to depend on the type of fluctuations and independent Rayleigh fluctuations of the signal amplitude are found to be manageable with more than 10-15 samples. Figures 3; references: 9 Russian.

UDC 621.385.64.01

Amplification Cutoff in Amplitron

18600134d Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 33 No 6, Jun 88 (manuscript received 16 Apr 86) pp 1237-1240

[Article by G. I. Churyumov]

[Abstract] Gain limitation and amplification cutoff in an amplitron are analyzed by the method of computer simulation on the basis of a self-consistent mathematical model in the two-dimensional and quasi-periodic approximations. The electron beam is assumed to interact with the synchronous space harmonic of the high-frequency field, in the single-frequency approximation, with both electrostatic and magnetostatic fields assumed to be uniform within the interaction space. Reflections of the high-frequency wave by both entrance and exit walls are disregarded. As initial conditions have been selected the geometrical dimensions of both cathode and anode, the number of active cavities, the electrical design parameters including electrodynamic characteristics of the device, and secondary-emission characteristics of the cathode. Theoretical calculations according to this model and numerical analysis of the results have yielded essential information about the interaction mechanism and about factors which influence the amplitron performance. The author thanks M. A. Fursayev for supplying experimental data nd V. N. Makarov for helpful comments. Figures 2; references 6: 5 Russian, 1 Western (in Russian translation).

UDC 621.385.623

Two-Dimensional Effects in Multicavity Klystrons Optimized for Maximum Efficiency

18600134e Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 33 No 6, Jun 88 (manuscript received 30 Apr 86) pp 1240-1249

[Article by A. V. Aksenchik and A. A. Kurayev]

[Abstract] Following an earlier design optimization of multicavity klystrons for maximum efficiency based on a one-dimensional mathematical "large particles" model of interaction, two-dimensional effects in such a klystron are not evaluated on the basis of a system of three nonlinear two-dimensional equations for each cavity. This two-dimensional mathematical "large particles" model of interaction assumes axisymmetric fields of the electron beam and of large particles simulating it so that the azimuthal electron velocity can be determined from the corresponding momentum integral. Both electric and magnetic fields of a large particle are calculated using the Lorentz transformation, the convergence of series describing the electric field being improved by application of the Krylov method. Both electric and magnetic fields in the gaps of cavities are calculated by the method of grids with successive upper-bound relaxation. Fields of the space charge are periodicized by numerical calculus. Calculations made on the basis of this model for a relativistic maximum-efficiency multicavity klystron and for a weakly relativistic one have yielded quantitative data on two-dimensional effects in each case and some qualitative similarities, namely regarding the mode of energy transfer, with a nonrelativistic klystron. Figures 4; references: 7 Russian.

UDC 621.385.63

Maximum Efficiency of O-Type Traveling-Wave Tube

18600134f Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 33 No 6, Jun 88 (manuscript received 29 Sep 86) pp 1249-1254

[Article by I. A. Mankin and V. Ye. Polyak]

[Abstract] Design optimization of an O-type traveling-wave tube with a longitudinally nonuniform retarding structure and a longitudinally periodic focusing magnetic structure for maximum efficiency and minimum current dip is considered, assuming power saturation and zero attenuation in the retarding structure. Such a structure with a radius equal to 1.0 per-unit and twice as large as that of the electron beam can yield theoretical efficiencies approaching 100 pct, according to the one-dimensional model of interaction, efficiencies approaching only 80 pct being attainable with a uniform retarding structure. As three optimizable dimensionless variables on which the maximum efficiency depends have been identified the magnitude of the input signal, the relative magnitude of the space charge, and the relative gain. Analytical and numerical evaluation of two dimensional effects influencing the electronic efficiency and the current dip, assuming optimum variation of the phase velocity along the retarding structure, not only establishes a dependence on the characteristics of the magnetic structure but also identifies space charge as the principal factor limiting the maximum attainable efficiency as much as to below 60 pct. Space charge is found to dynamically broaden the electron beam and radially grade the distribution of the longitudinal high-frequency field. While a slightly higher efficiency is attainable with an alternating magnetic field and a completely shielded cathode, according to calculations, a much smaller current dip is attainable with a constant magnetic field. The authors thank B. L. Usherovich for assisting in calculations and for analysis of results based on the two dimensional model. Figures 6; references 11: 10 Russian, 1 Western (in Russian translation).

UDC 621.385.69.01

Relativistic Multiwave Ubitron

18600134j Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 33 No 6, Jun 88 (manuscript received 15 Dec 86) pp 1327-1329

[Article by A. V. Korzhenevskiy and V. A. Cherepenin]

[Abstract] The performance of a relativistic multiwave ubitron amplifier based on a flat wiggler suitable for infrared free-electron lasers is analyzed by numerical simulation of processes occurring in such a device. An electron beam propagating through free wiggler space in a space-periodic nonuniform focusing magnetic field and a self-consistent high-frequency electric field is considered, with the nonuni-

formity scale of the magnetic field assumed to be larger than the amplitude of transverse electron oscillations. On the basis of this model have been calculated the longitudinal profiles of the electronic efficiency and of the transverse electric field component as well as the radiation pattern of such an electron beam in terms of angular radiation power distribution. The results reveal that transverse nonuniformity of the focusing magnetic field enhances the performance of such a ubitron by increasing its efficiency. Figures 2; references 8: 5 Russian, 3 Western.

UDC 656.254.16:621.396.4

Radio Relay Communication Along Kuybyshev Railroad Line

18600130d Moscow AVTOMATIKA TELEMEKHANIKA I SVYAZ in Russian No 6, Jun 88 pp 26-27

[Article by V. A. Konyashin, deputy chief, Signalization and Communication Service, Kuybyshev railroad line]

[Abstract] The radio link between the Kuybyshev railroad line and the three lines connecting to it (Southeastern, Southern Ural, Volga) is being updated by replacement of equipment which has become obsolete after 19 years in service and by utilization of existing structures still fit for longer service. The radio link operated partly and will operate fully with time division of channels by the delta-modulation method. The new equipment will also include appropriate measurement hardware for monitoring, inspection, and maintenance.

UDC 621.395.4:621.376.5

Preparation of IKM-120 Pulse-Code-Modulation Terminals for Service

18600130b Moscow AVTOMATIKA TELEMEKHANIKA I SVYAZ in Russian No 6, Jun 88 pp 14-16

[Article by A. D. Baranenko, chief, Production Unit, Leningrad-Passenger-Moscow track section of Oktyabrskiy railroad line, V. P. Glushko, assistant professor, Leningrad Institute of Railroad Transportation Engineers, and A. P. Koshelev, senior scientific associate]

[Abstract] Preparation of IKM-120 PCM communication terminals for service on track sections of a railroad line begins with selection of instruments in the appropriate precision class and their installation in three bays: SATsO bay for analog/digital equipment, SVVG-1 bay for secondary time-base group equipment, and SLO-1 bay for line equipment. Each bay is then tuned individually for proper operation according to specifications, whereupon the system is checked for compatible operation of all three bays.

UDC 621.372.8:621.315.61

Estimation of Losses in Welded Joints Along Fiber-Optic Cable

18600146a Moscow ELEKTROSVYAZ in Russian No 5, May 88 (manuscript received 12 Nov 87) pp 43-44

[Article by N. M. Volkova and V. V. Grigorash]

[Abstract] Losses in welded joints along a fiber-optic cable are estimated n the basis of theoretical relations and service data, the latter gathered in the Moscow metropolitan telephone network by reflection measurements in both directions at 133 points along a 3754 m long cable and processed statistically in the form of histograms. The losses which depend on the characteristics of joined fibers are those due to different core diameters and those to differentfiber apertures, these two losses being geometrically additive. The losses which depend on the method of joining are those due to radial misalignment and those due to angular misalignment, the latter as well as those due to Fresnel reflection at the fiber ends being negligible. The loss due to radial misalignment during welding and the resultant loss due to dimensional differences between the joined fibers are again geometrically additive. The theoretical estimates agree within 0.2 dB with those based on measurements, being generally higher. Reducing the total attenuation requires, evidently, tightening the tolerances on fiber dimensions and the control of the welding process. Figures 2; references: 1 Russian.

UDC 621.383.4:621.383.52

Optimization of Frequency-Correcting Circuits in Photodetector for Fiber-Optic Transmission System

18600146b Moscow RADIOTEKHNIKA in Russian No 5, May 88 (manuscript received 28 Jun 86) pp 45-48

[Article by V. T. Podlesnykh, Ye. A. Potylitsyn, and N. D. Simachev]

[Abstract] A photodetector for fiber-optic transmission systems is considered which consists of a preamplifier with resistive negative feedback and two identical common-emitter transistor amplifier-corrector stages, frequency correction by lifting the amplitude-frequency characteristic of such a photodetector being possible by optimizing the two emitter circuits. Resistance and capacitance calculations are based on the equivalent-circuit diagram, taking into account high internal impedance of the signal source and high impedance of the load. The optimization algorithm is programmed for calibrating theoretical values of the resultant photodetector transfer function against empirical ones. Numerical calculations based on typical input data indicate the feasibility of optimizing a photodetector with a noncorrectible preamplifier by optimizing the two amplifier stages for operations under conditions of intersymbol interference, with the operating point of that preamplifier selected so as to ensure minimum noise current. Figures 3; references 6: 4 Russian, 2 Western (1 in Russian translation).

UDC 621.372

Survey of Optical Transmission Systems and Cables in Western Countries

18600146c Moscow RADIOTEKHNIKA in Russian No 5, May 88 (manuscript received 19 Oct 87) pp 48-51

[Article by G. I. Grodnev]

[Abstract] The status of optical transmission systems and cables in six Western countries (Japan, United States, United Kingdom, Federal Republic of Germany, Canada, France), leaders in this field since the late nineteen seventies and early nineteen eighties, is surveyed with emphasis on recent and current developments. Japanese optical cables are built with graded-index fibers. American optical cables are predominately of the single-mode type operating with lasers as light sources, but multimode cables operating with light-emitting diodes have also entered the field. An integrated optical multipurpose transmission system with switching of channels and wave packets is being developed in England for local communication networks. Integrated multipurpose broadband optical transmission systems are already available in West Germany. Canadian optical cables are built with axially slotted fiber cores, 70 percent of all cables installed on supports or in underground ducts and 30 percent buried. French optical cables

consist of 10 fibers carried by helically slotted plastic rods. Both capacity and range of optical transmission systems are steadily increased, their applications are being extended beyond telephone and television as well as data transmission networks, and the outlook for the nineteen nineties is excellent worldwide. References 18: 5 Russian, 13 Western (2 in Russian translation).

UDC 621.391.14

Energy Spectra of Noise-Like Signals

18600146d Moscow RADIOTEKHNIKA in Russian No 5, May 88 (manuscript received 30 Sep 86) pp 52-56

[Article by N. I. Smirnov and S. F. Gorgadze]

[Abstract] The energy spectra of phase-keyed composite signals comprising M-sequences, Gold pseudorandom (reconstituted) sequences, random sequences, or pseudorandom sequences with various number of repetitions are analyzed for the statistical characteristics of the spectral power density and its excursions. The expression for that spectral power density containsterms independent of the code sequence and terms dependent on its structure, some of the latter terms with a periodic autocorrelation function and others with an aperiodic one as multipliers. Each of these three groups of terms is evaluated for each type of sequences forming a phase-keyed composite signal. The r.m.s. deviation as well as the integral distribution function of spectral power density excursions and the maximum spectral power density excursion, both normalized to the energy of a square pulse of equivalent duration and amplitude, have been calculated for each case. The results indicate ways to improve the interference immunity of processing such signals. Figures 4; tables 1; references 9: 8 Russian, 1 Western (in Russian translation).

Applications for Series K555 Integrated-Microcircuit Chips

18600129c Moscow RADIO in Russian No 5, May 88 pp 36-38

[Article by S. Alekseyev, Moscow]

[Abstract] The series K555 integrated-microcircuit chip can be laid out and connected with the appropriate configuration of inputs and outputs to suit various applications such as multiplexers, binary adders, NAND logic and EXCLUSIVE-OR logic, also prioritizing encoder. Several variants of these devices are described and their operation is explained. Figures 16.

New Series KT837 Transistors for Wide Range of Applications: Part 1

18600129d Moscow RADIO in Russian No 5, May 88 p 60

[Article by D. Aksenov and A. Yushin, Moscow]

[Abstract] Eighteen new series KT837 diffused-epitaxial PNP silicon transistors built into hermetic plastic cases are now produced for low-frequency switches and output amplifiers, audio-frequency converters, d.c. voltage stabilizers, and many other low-frequency applications. The first part of their data sheet includes outline and mounting dimensions, electrical parameters at 25 deg C room temperature, and limiting performance characteristics. Each weighs 2.5 g. Soldering of the leads for connection to other circuit components must be done within a time of 2 s at a temperature not higher than 235 deg C and least 4 mm away from the case. Figures 6.

UDC 621.313.017

Efficiency of Multilayer Ferromagnetic Shields

18600156a Novocherkassk IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENII: ELEKTROMEKHANIKA in Russian No 5, May 88 (manuscript received 31 Jan 86) pp 5-10

[Article by Yuriy Aleksandrovich Trofimov, candidate of technical sciences, assistant professor, Novgorod Institute of Agriculture]

[Abstract] The efficiency of multilayer ferromagnetic shields for tape drives in audio-video recording equipment is evaluated theoretically, assuming a cylindrical shield composed of n equally thick layers around a cylindrical core of high-mu material with a winding which produces a symmetric 2p magnetic field. The core material is assumed to have infinite magnetic permeability and zero electrical conductivity. The winding is assumed to constitute an array of circuits, its active part embedded parallel to the core axis and its extensions at both ends bent into circular arcs in planes perpendicular to the core axis. The shield is assumed to consist of thin layers forming a shell, its material having a finite magnetic permeability and zero electrical conductivity. Both core and shield are assumed to be infinitely long. The circumferential linear current density in the winding is assumed to be a piecewise-continuous function of the azimuthal coordinate. Calculations are facilitated by expansion of this function into a Fourier series of space harmonics and description of the magnetic field with a scalar potential which satisfies the three-dimensional Laplace equation. The analytical solution is followed by numerical calculations of a two-layer shield and graphical representation of the results. Figures 3; references 8: 6 Russian, 2 Western.

UDC 621.313.33.001.5

Efficiency of Interaction of Conductor and Resultant Electromagnetic Field

18600156b Novocherkassk IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENII: ELEKTROMEKHANIKA in Russian No 5, May 88 (manuscript received 18 Feb 87) pp 21-28

[Article by Dmitriy Vasilyevich Makarenko, candidate of technical sciences, assistant professor, Odessa Institute of Marine Fleet Engineers]

[Abstract] Interaction of a rotating conductor and an electromagnetic field is analyzed, the electromagnetic field being the resultant of two interfering wave fields not necessarily equal in magnitude. First is considered interaction within the region of the resultant field around the center, where both interfering waves are 180 deg out of phase and the interaction is therefore weakest. Next is considered the resultant field of a circular loop, its distribution within that region being most intricate. Finally is considered the resultant field of two interfering waves with intersecting fronts, for which case the theoretically calculated harmonic content of the conductor e.m.f. is check against the results of measurements made on a MT-12-6 wound-rotor induction motor with skewed stator and rotor slots. Figures 5; references 10: 9 Russian, 1 Western.

UDC 621.316.925.2

Design and Selection of Diagnostic Testing Devices to be Built into Protective Relays

18600156c Novocherkassk IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENII: ELEKTROMEKHANIKA in Russian No 5, May 88 (manuscript received 25 Dec 86) pp 83-88

[Article by Aleksey Ivanovich Shalin, candidate of technical sciences, assistant professor and Genadiy Aleksandrovich Sarapulov, candidate of technical sciences, assistant professor, Novosibirsk Institute of Electrical Engineering]

[Abstract] A method of designing devices to be built into new protective relays for automatic inspection of the latter is proposed, taking into consideration the trend toward use of semiconductor devices for protective relaying. The design of such an inspection device is coordinated with the design of its relay, by paralleling the respective two algorithms. Two such devices are considered, a plain continuous monitor and a compound continuous-periodic one. A comparative analysis of their operating principles and performance characteristics indicates that the continuous monitor responds faster to a fault, within 10-15 s, but may not be sufficiently reliable. Both devices are adequate for inspection of both logic and sensor components of a relay. Figures 1; references: 7 Russian.

UDC 621.317.784:624.382.537

Main Parameters of Thin-Film Galvanogyromagnetic Microwave Electromagnetic-Field Transducers

18600118h Kiev IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: RADIOELEKTRONIKA in Russian Vol 31 No 5, May 88 (manuscript received after revision 6 Apr 87) pp 81-83

[Article by V. S. Vuntesmeri]

[Abstract] Galvanogyromagnetic electromagnetic-field transducers are a new kind of thin-film microwave device useful for measuring such quantities as the Poynting vector, which requires multiplying electric and magnetic field components so as to take into account their phase relation. The operation of such a device, a parametric field detector-converter, is based on the anomalous Hall effect in a ferromagnetic film under conditions of ferromagnetic resonance in a microwave magnetic field. The conversion process in these devices is readily analyzed and their performance characteristics evaluated with the aid of the magentroresistive-susceptibility tensor. Experimental specimens were produced with Permalloy film and tested at room temperature in the 3 GHz frequency band with up to 6 MHz deviation from the center frequency, the results indicating a high response speed of the order of 10^{-8}-10^{-9} s with not more than 20 percent nonlinearity and minimal parasitic signal level. References: 2 Russian.

UDC 621.397.61:621.397.132.049.77 CCD

Color Encoding in Photosensitive Multisignal Charge-Coupled-Device Arrays

18600132b Moscow TEKHNIKA KINO I TELEVIDENIYA in Russian No 6, Jun 88 pp 13-21

[Article by G. I. Vishnevskiy, V. Yu. Berezin, and S. A. Ioffe]

[Abstract] Use of photosensitive CCD arrays as solid-state multisignal replacement of vidicon tubes in color TV cameras facilitates precise spatial and spectral discretizaton of the transmitted image by means of encoding color filters, filters with a mosaic structure being most suitable for such small arrays without storage space laid out in a coordinated line-frame pattern and featuring a low level of color crosstalk distortion. Following a theoretical analysis of the noise conversion process in the luminance channel, constant-field and variable-field color crosstalk distortions are analyzed quantitatively for the purpose of camera design optimization. A procedure for minicomputer-aided design optimization has been devised, using a standard CAMAC crate for hardware modeling and with software formulated in PASCAL-2, MACROASSEMBLER OS, RAFOS-2 languages for execution of programs in both interactive and autonomous modes. The programs include "Filtration of Low Space Frequencies," "Balancing of Signals," "Equalization of Signals," "Filtration of High-Frequency Components," "Color Decoding," "Arraying," also several auxiliary ones. The procedure was used for optimizing the design of a single-chip color TV camera. Figures 8; tables 1; references 17: 8 Russian, 9 Western.

UDC 621.397.6.049.77:681.7.008

Large Fiber-Optic Television Screen

18600132c Moscow TEKHNIKA KINO I TELEVIDENIYA in Russian No 6, Jun 88 pp 21-24

[Article by B. M. Dzhavadov, Azerbaijan Polytechnic Institute imeni Ch. Ildrym]

[Abstract] A new TV screen has been developed, a fiber-optic image transformer which consists of sufficiently many parallel polymer fibers running from a common inlet terminal horizontally across the frame. Formation of scan lines and integration of small such screens into a large or superlarge one are shown schematically. Such a screen can be designed as a flat one for a projector of moving images in the transillumination mode, a projector for this application operating with a longitudinally or transversely electron-beam pumped laser. It can also be designed for operation with a one-dimensional scanistor, for operation with a fiber-optic image converter, and for integral color holography. Figures 5; references 3: 2 Russian, 1 Western.

UDC 778.53 KINOR-35-7R

'Kinor-35-7R' New Portable Motion-Picture Camera

18600132d Moscow TEKHNIKA KINO I TELEVIDENIYA in Russian No 6, Jun 88 pp 25-28

[Article by V. F. Gordeyev, Ye. N. Borisov, N. A. Kozlov, and Ye. G. Berdnikov, Moscow Design Office for Motion Picture Apparatus, Scientific-Industrial Association 'Kadr' (Frame)]

[Abstract] A new portable motion-picture camera KINOR-35-7R has been developed and recommended for production. Its construction is a modular one, designed for most convenient assembly and disassembly. Its kinematic chain consists of a shutter disk, an electric motor, a sprocket drum, a pull-down mechanism, and a shutter mirror. The camera shoots pictures at rates of 24, 25, or 1-36 frames/s, the noise level being 36 dB abs or 40 dB abs with and without soft sound-proof lining of the box respectively. The shutter opens to a 172.8 deg angle. the camera, weighing 7 kg, compares with the Bolex 16 PRO and the 4KCP designed according to similar principles. Figures 4; references: 6 Russian.

UDC 537.876.4.01

Mixing of Electromagnetic Signals in Quantum Superlattices

18600134g Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 33 No 6, Jun 88 (manuscript received 21 Nov 85) pp 1278-1283

[Article by L. K. Orlov]

[Abstract] Performance characteristics of a periodic quantum superlattice such as that in a nonlinear $Ge/Ge_{1-x}Si_x$-heterojunction milimetric-wave mixer are calculated analytically and numerically with the aid of the density matrix for the collision integral, Fourier series

expansion of that integral, and reduction to a system of linear algebraic equations. The characteristics include field dependence of the current density and of the differential conductance as well as of the population difference between upper and lower minibands at various levels of the tunneling current, also dependence of the conversion efficiency in terms of power loss on the heterodyne a.c. voltage amplitude and d.c. bias voltage. these calculations reveal a further shift of the operating point into the asymmetric range of the current-voltage characteristic owing to the rectifier effect. The author thanks Yu. A. Romanov and O. N. Filatov for helpful discussions and valuable comments. Figures 5; references 15: 13 Russian, 2 Western.

UDC 621.373.826

Instrument for Measuring Wavefront Form of Radiation From Continuous-Wave Laser

18600142a Leningrad OPTIKO-MEKHANICHESKAYA PROMYSHLENNOST in Russian No 5, May 88 (manuscript received 14 Jun 87) pp 17-20

[Article by M. L. Grabalin, S. I. Klimentyev, V. V. Kononov, V. I. Kuprenyuk, C. N. Leonov, and A. G. Skepko]

[Abstract] An instrument for measuring changes in the wavefront form of radiation from a continuous-wave infrared laser by the Hartman method is described, its aperture for the laser beam being divided into a grid of N subapertures with a lens in each and a coordinate-sensitive radiation receiver in the focal plane of each lens. Satisfactory accuracy is attained already with approximately 100 subapertures, but the scanning speed must not exceed 100 frames/s. The display screen has a resolution of 256x256 points in any of three colors. Data gathering as well as data preprocessing and subsequent analog-to-digital conversion for processing have been automated with the aid of an SM-4 minicomputer and a CAMAC crate. The instrument was tested on radiation from an ILGN-701 continuous-wave CO_2-laser, a telescope with x18 magnification expanding the laser beam to a diameter of approximately 150 mm. Calibration against large-scale distortions of "wedge" and "sphere" types indicates that the r.m.s. error increases by 15 pct when the scanning speed is increased from 15 to 25 frames/s and is twice as large for a laser beam of 20 W threshold power than for a laser beam of 70 W power with a correspondingly higher signal-to-noise ratio, the maximum power rating of the radiation receiver grid being 500 W. Figures 3; references 9: 6 Russian, 3 Western.

UDC 681.383:621.373.826.08

Photodetector for Laser-Type Measuring Instruments

18600142b Leningrad OPTIKO-MEKHANICHESKAYA PROMYSHLENNOST in Russian No 5, May 88 (manuscript received 15 Jul 87) pp 38-40

[Article by V. N. Gorbachev, A. V. Zolotov, and S. I. Soskin]

[Abstract] A photodetector combining a wide dynamic range with a sufficiently high response speed has been developed for measurement of linear and angular displacements by the method of optical heterodyning with laser-type instruments. It also features a high interference immunity, which makes it suitable for monitoring the performance of machine tools in a production plant. Its optomechanical module adapted for operation with a two-frequency laser includes a polarizer in which two orthogonally polarized laser beams produce beats, a focusing lens, a magnifying plate, an FD-256 photodiode, a light-emitting indicator diode, and an output rosette. The electrical circuit includes a triaxial signal shaper as well as components necessary for inspection and adjustment in addition to a two-stage amplifier, the first stage on a series K118UN1D high-gain (50 at 5 MHz) microcircuit chip with high output impedance and the second stage on a low-gain (5) transistor matching the first one to a comparator with low input impedance which produces paraphase signals. Two diodes at the photodetector input protect the comparator against overvoltage. Signals are transmitted from the output rosette through a twisted two-conductor cable to data processing equipment, the cable with a characteristic impedance of 140 ohms ensuring optimum data transmission with maximum interference immunity at frequencies up to 5 MHz. The photodetector is designed for operation with a 0.25 mW two-frequency laser and a reflector up to 100 m away. Figures 3; references 4: 3 Russian, 1 Western (in Russian translation).

UDC 621.391:681.383.181

Optoelectronic Instrument IDTZ-1 for Measuring Diameter and Temperature of Optical-Fiber Blanks

18600142c Leningrad OPTIKO-MEKHANICHESKAYA PROMYSHLENNOST in Russian No 5, May 88 (manuscript received 26 May 87) pp 53-54

[Article by R. M. Galiulin, Z. M. Gafarov, and K. F. Tagirova]

[Abstract] An optoelectronic instrument has been developed for simultaneous contactless measurement of the diameter and the temperature during high-temperature heat treatment of optical-fiber blanks. It includes an FPU-36 photodetector commercially produced in the USSR, a linear array of photodiodes with an MOS-structure. The projection of a heat-treated blank onto the plane of that photodetector is scanned electronically so that the time distribution of the analog signal from the discrete photodiode array corresponds to the space distribution of the projecting light. After the video signal has been extracted and amplified, it is linearly filtered so that the geometrical dark noise is reduced to 2.5 pct of its original level. Subsequent nonlinear processing of that signal for a determination of the projection diameter, which is proportional to the object diameter, involves adaptive formation of a tracking threshold and comparison with a reference as well as generation of a control signal proportional to the deviation from that reference. The photosensitivity is automatically regulated by variation of the exposure time at a constant scanning rate. The electronic components of this instrument are assembled into five modules including series K176 or K561, K544, and K155 microcircuit chips, all on a 90x120 mm^2 large printed-circuit board. The diameter range of the instrument is 0.3-30 mm, the maximum measurement error being 0.5 pct, and its temperature range is

800-2200 deg C with a sensitivity to deviations from nominal equal to 1 pct of a given temperature subrange. The instrument takes 250 readings per second. Two modifications, IDTZ-2 and IDTZ-3 with 512 and 1024 photocells respectively, are also available. Figures 1.

UDC 621.001.2

Synchronous Demodulation of Weak Optical Signal With Indeterminate Phase

18600142d Leningrad OPTIKO-MEKHANICHESKAYA PROMYSHLENNOST in Russian No 5, May 88 (manuscript received 1 Jun 87) pp 54-55

[Article by B.Ye. Smolyanskiy]

[Abstract] While synchronous processing of optical signals ensures the highest practical signal-to-noise ratio, almost as high as ensured by optimal filtration, synchronous processing of weak optical signals must take into account indeterminacy of the fluctuating signal phase. This problem arises in automatic tracking, typically during guidance of a telescope and attendant movement of the image in the modulator-analyzer plane. In this case the signal is processed in two stages, preamplification with automatic gain control or with amplitude limitation and prefiltration in a common channel prior to synchronization being followed by extraction of the signal vector components in two parallel channel branches by two synchronous demodulators in quadrature. These two components, after power amplification, control the corrector drive. The modulus of a weak optical signal with fluctuating phase is determined with the aid of two coherent balanced modulators in quadrature, without use of active devices and thus over a wide dynamic range. A guidance system based on this principle includes an objective lens, an optical modulator-analyzer, a radiation receiver with an amplifier, a band-pass filter, two synchronous modulators with a low-pass filter each, two balanced secondary modulators with a carrier-frequency signal generator for each, a summator, an amplitude detector, a low-pass output filter, a voltmeter, two power amplifiers, two motors driving the corrector along two mutually orthogonal coordinate axes, and a switch for changing operation from automatic regulation mode to measurement mode or vice versa. Figures 1; references 6: Russian.

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Miniature Collimating Objective for Fiber-Optic Devices

18600142e Leningrad OPTIKO-MEKHANICHESKAYA PROMYSHLENNOST in Russian No 5, May 88 (manuscript received 11 Jun 87) pp 56-57

[Article by T.V. Basistova and A.L. Dmitriyev]

[Abstract] A miniature collimating objective has been developed and built especially for use with fiber-optic devices operating within the 800-1400 nm infrared range of the radiation spectrum. Its compound lens, designed for minimum spherical aberration at 800-900 nm and 1200-1400 nm wavelengths, consists of a convexo-plane lens followed by two convexo-concave ones with successively larger curvatures. All three are made of TBF4 or TF10 optical glass and have the same 9 mm diameter for mounting in a common 7 mm long cylindrical frame. The objective has a focal length of 15.0 mm, a relatively aperture of 1:1.67, a 1.5 mm wide field of view, a 0.95 transmission coefficient, and a 330 lines/mm resolution at the center. Figures 2; tables 1; references 8: 5 Russian, 3 Western (2 in Russian translation).

Doping of GaAs Neutron Bombardment at High Temperatures

18600149a Leningrad FIZIKA I TEKHNIKA POLUPROVODNIKOV in Russian Vol 22 No 6, Jun 88 (manuscript received 15 Apr 87) pp 1025-1030

[Article by N. G. Kolin, L. V. Kulikova, and V. B. Osvenskiy, Scientific Research Institute of Physical Chemistry imeni L. Ya. Karpov, Obninsk branch]

[Abstract] An experimental study of GaAs doping with Ge and Se by neutron bombardment at high temperatures was made, high resistivity n-Ga-As crystals grown by the Czochralski method being treated in a VVR-ts water-cooled water moderated reactor with thermal and fast neutrons in a 10:1 flux density ratio. The temperature was varied over the 70-800 deg C range and the fluence of thermal neutrons was varied so as to hold the combined Ge and Se impurity concentration within 10^{17}-10^{18}cm^{-3} with the flux density of thermal neutrons remaining 5.10^{13}cm^{-2}.s^{-1}. Subsequent electrophysical measurements were made before and after annealing of specimens at 900 deg C for 20 min. Electron concentration and mobility were determined from Hall-effect measurements, electrical conductivity was measured by the van-der-Pau method, and the lattice period was measured by the bond method with fourth-order reflections by the (111) plane. The data indicate a lower energy threshold for defect formation and a higher probability of subsequent defect annihilation at centers than after neutron bombardment at temperatures below 70 deg C, also a higher probability of freed vacancies and interstitial impurity atoms drifting towards sinks. Temperature-dependent interaction of radiative defects with other defects and with impurities evidently produces various complexes which then break up. Most stable were found to be defect complexes forming during neutron bombardment at 400 deg C, these defects being curable only by annealing at temperatures above 600 deg C. Figures 4; tables 1; references: 3 Russian.

Restructurization of 1/f-Noise in GaAs by Light

18600149b Leningrad FIZIKA I TEKHNIKA POLUPROVODNIKOV in Russian Vol 22 No 6, Jun 88 (manuscript received 25 Sep 87) pp 1049-1052

[Article by N. V. Dyakonova, M. Ye. Levinshteyn, and S. L. Rumyantsev, Institute of Engineering Physics imeni A. F. Ioffe, USSR Academy of Sciences, Leningrad]

[Abstract] An experimental study of 1/f-noise in GaAs was made, illumination of this and other semiconductor materials having been found earlier to alter the spectrum of that noise. Specimens of pure n-GaAs crystals were grown on n^{plus}- substrates by the epitaxial process from the gaseous phase. The electron concentration of the order of 10^{15} cm^{-3} remained constant over the 77-500 K temperature range, while the electron mobility changed from 0.7 m^2/V(V.s) at room temperature to 5-7 m^2/(V.s) at 77 K. Exposure to low-intensity light from a plain incandescent lamp, which did not decrease the electrical resistivity by more than 0.1-1 pct, was found to completely restructure the 1/f-noise spectrum. Measurements established a dependence of the relative spectral density of this noise on both the wavelength of incident light and the ambient temperature. Light was found to generally abate the low-frequency noise and boost the high-frequency noise. The authors thank M. I. Dyakonov for interest and V. S. Bolbot for preparing the specimens. Figures 4; references 10: 5 Russian, 5 Western (1 in Russian translation).

Dependence of Properties of Pure Semiinsulating GaAs on Pressure of As-Vapor During Heat Treatment

18600149c Leningrad FIZIKA I TEKHNIKA POLUPROVODNIKOV in Russian Vol 22 No 6, Jun 88 (manuscript received 21 Oct 87) pp 1108-1110

[Article by I. I. Pokaznoy, F. S. Shishiyanu, I. M. Tiginyanu, V. P. Nikoforov, and V. P. Shontya, Kishinev Polytechnic Institute imeni S. Lazo]

[Abstract] An experimental study of pure semiinsulating n-GaAs was made, for the purpose of determining the dependence of key properties of the surface layer on the pressure of As-Vapor during heat treatment. Single crystals of high-resistivity (10^8 ohm-cm) n-GaAs, grown by the Czochralski method with (100) orientation, were heat treated at 850 deg C for 1 h under an As-vapor pressure which was varied over the 0.098-2.1 MPa range. Defectiveness, electron concentration, electrical resistivity, and photoconductivity, also edge luminescence and its extinction spectrum were measured at two temperatures, 77 K and 300 K, before and after layer-by-layer surface etching with an 8:1:1 H_2SO_4:H_2O_2: H_2O solution. Luminescence was excited with a He-Ne laser operating at the 630 nm wavelength. Both electron concentration and electrical resistivity were found to increase monotonically with increasing As-vapor pressure, while the wide photoconductivity peak remained within the 1.48 eV bank but its magnitude decreased and another peak appeared within the 1.41 eV band. These trends are explained by structural changes in the surface layer, namely formation of As-vacancy defects under low As-vapor pressure and formation of antistructural As_{Ga}-donor defects under high As-vapor pressure. Figures 2; references 10: 4 Russian, 6 Western.

Suppression of 1/f-Noise in Silicon by Light

18600149d Leningrad FIZIKA I TEKHNIKA POLUPROVODNIKOV in Russian Vol 22 No 6, Jun 88 (manuscript received 8 Dec 87) pp 1120-1122

[Article by Ye. G. Guk, N. V.Dyakonova, and M. Ye. Levinshteyn, Institute of Engineering Physics imeni A. F. Ioffe, USSR Academy of Sciences, Leningrad]

[Abstract] An experimental study of 1/f-noise in Si was made, this noise being known to be generated at the surface as well within the bulk of a crystal. An approximately 0.1 mm thick wafer of n-Si was produced by the floating-zone method, with an electrical resistivity of the order of 300 ohm.cm (concentration of free electrons $1.6.10^{13}$ cm^{-3}) and a dislocation density of the order of 3.10^4 cm^{-2}. Two 500-1000 nm thick n^{plus}-type surface layers with 10^{19} cm^{-3} donor concentration, one on each side of the wafer, were produced by doping with phosphorus prior to deposition and subsequent brazing of Ni electrodes at 550 deg C under vacuum. This structure was cut into test specimens by means of laser beam. The results of measurements indicate that 1/f noise in n-Si can be generated at the surface even when the magnitude of the

Hooge constant after surface treatment is approximately 10^{-3}. Illumination of the n-Si specimens with light from a plain incandescent lamp reduced the 1/f-noise appreciably without altering its spectrum and decreased the Hooge constant to 2.10^{-4} or even 2.10^{-5} when the photon energy exceeded the gap energy of silicon,according to measurements made with the aid of an MDR-6 monochromator. The electrical resistance of these specimens did not decrease by more than 1.5 pct, precluding increase of the electron concentration as mechanism of noise suppression. The authors thank S. N. Vaynshteyn and S. L. Rumyantsev for assistance. Figures 2; references: 3 Russian, 9 Western.

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