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USSR Report

ELECTRONICS AND ELECTRICAL ENGINEERING

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USSR REPORT

ELECTRONICS AND ELECTRICAL ENGINEERING

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BRAGG REFLECTION OF SURFACE ELECTROACOUSTIC SHEAR WAVES

Moscow AKUSTICHESKIY ZHURNAL in Russian Vol 30, No 1, Jan-Feb 84
(manuscript received 27 Apr 82) pp 47-50

GULYAYEV, Yu. V., KURACH, T. N., PLESSKIY, V. P. and TERESHKOV, V. P.,
Institute of Radio Physics and Electronics, UkSSR Academy of Sciences

[Abstract] Bragg reflection of surface electroacoustic shear waves in piezoelectric media is analyzed and the width of the suppression band, which depends on the excitation level, is determined. The piezoelectric half-space is assumed to have an axis of sixth-order symmetry and a metallized boundary surface with an "inertia load" small periodic perturbation. An analysis of the dispersion equation and a correlation with reflection of volume electroacoustic shear waves reveals that, owing to the small difference between the respective velocities, the Bragg suppression band for quasi-volume surface waves will merge with the range of wave attenuation by scattering into the volume when $K^2/(1+K^2) + m_0 Q/2\rho - m_1 Q/4\rho \leq 0$ (K - coefficient of electromechanical coupling, ρ - density of piezoelectric material, $m(x)=m + m_0 \cos Qx$, $Q=2\pi L$, L - space period of structure). The authors thank A. N. Avdeyev and V. I. Grigor'yevskiy for helpful discussion of the work. Figures 3, references 8: 5 Russian, 3 Western.
[202-2415]

REFLECTION OF VOLUME WAVES IN MULTILAYER STRUCTURES

Moscow AKUSTICHESKIY ZHURNAL in Russian Vol 30, No 1, Jan-Feb 84
(manuscript received 15 Jun 82) pp 110-113

RAZGONYAYEV, V. K. and YAKOVKIN, I. B., Institute of Semiconductor Physics,
Siberian Department, USSR Academy of Sciences

[Abstract] The performance characteristics of devices on surface acoustic waves are immunized to influence coexisting volume waves by coarsening the bottom surface of the sound guide or mounting it on a wedge as a substrate.

Proper design of such a multilayer structure requires calculation of the reflection coefficients for volume waves at arbitrary incidence angles. This problem is solved in two steps. First the wave propagation geometry is determined in a piezoelectric medium, in the quasi-static approximation and according to the principle of phase synchronism. Typical results are shown for an interdigital transducer with YZ-cut LiNbO_3 crystal. Then the reflection coefficients are calculated, from the appropriate boundary conditions of continuity or discontinuity for three components of the displacement vector, three components of mechanical stress, electric potential, and components of the dielectric induction vector. Solution of the corresponding system of linear equations yields the reflection coefficients as well as the transmission coefficients for longitudinal and transverse waves as functions of the incidence angle at the free surface of the LiNbO_3 YZ-cut (critical incidence angle $\sim 35^\circ$). The results indicate that minimizing the energy of reflected waves requires matching the high-Q piezoelectric substrate with a low-Q absorber such as an acoustic interlayer of correct thickness. Design and performance data on a $\text{LiNbO}_3/\text{SiO}_2/\text{polyethylene}$ structure illustrate this concept. Figures 6, references 2: 1 Russian, 1 Western.
[202-2415]

UDC 534

RADIATION PATTERN OF UNILATERAL PISTON IN ACOUSTIC SHIELD OF FINITE DIMENSIONS AND VARIABLE IMPEDANCE

Moscow AKUSTICHESKIY ZHURNAL in Russian Vol 30, No 1, Jan-Feb 84
(manuscript received 22 Jun 82) pp 114-117

SHABROV, A. A.

[Abstract] The radiation pattern of a unilateral piston in an acoustic shield with a diameter larger than the wavelength is calculated, a shield consisting of stiff and soft layers in various configurations and used as a device whose acoustic impedance can be varied for regulation of the radiation pattern. The problem is solved with the aid of oblate spheroidal eigenfunctions and the general solution to the corresponding wave equation for the velocity potential. The results indicate that a shield with perfectly stiff front layer and perfectly soft back layer is almost equivalent to an all-stiff shield, while a shield with perfectly soft front layer and perfectly stiff back layer is almost equivalent to an all-soft shield, this equivalence applying to the major front lobe and to side lobes within the $\pm 120^\circ$ sector of the radiation pattern. Insertion of a stiff interlayer between two soft shield layers widens the major front lobe and lengthens the back lobe. Insertion of a soft interlayer between two stiff shield layers eliminates the axial dip and shortens the back lobe. The radiation pattern of the piston can be further modified by varying the areas of the shield layers. When the thicknesses of the shield layers are much smaller than the wavelength, then the soft layers govern the radiation pattern. Figures 5, references 6: 4 Russian, 2 Western.
[202-2415]

INVESTIGATION OF COMPLEX-ENVELOPE DETECTOR

Moscow RADIOTEKHNIKA in Russian No 2, Feb 84 (manuscript received, after condensation, 31 Jun 83) pp 38-40

SULLAKATKO, T. Yu.

[Abstract] Two complex-envelope detectors are considered for processing short pulse trains originating from acoustic sources in accordance with an approximate Hilbert transformation. The first detector is an analog one for which the continuous Hilbert operator is replaced by its finite-dimensional approximation. Instead of a filter, it has a weighting adder and a delay line with the appropriate number of output taps. Adding an optimum filter on the input side is preferable to connecting an extra noise suppressor to the center tap of the delay line. The other detector is a digital one, with shift registers instead of the delay line and with digital circuits replacing the adder and multipliers, requiring an analog-to-digital converter on the input side. The errors of both detectors can be minimized by optimization of the Hilbert coefficients, errors of rounding and truncation in the digital detector as well as by optimization of the quantization process. Errors of the analog-to-digital converter are treated as noise, to be suppressed accordingly. References 5: 3 Russian, 2 Western (both in Russian translation).

[165-2415]

ANTENNAS AND PROPAGATION

REPLACEMENT OF TELEVISION TRANSMITTER ANTENNA IN LOW-POWER RADIO TELEVISION STATION WITH AID OF HELICOPTER

Moscow VESTNIK SVYAZI in Russian No 12, Dec 83 pp 16-17

IVANOV, A. A., chief engineer, Karelian Radio Television Relaying Production Center, and REZNIKOV, P. G., chief, production laboratory

[Abstract] One step in reconstruction of the Pudozh (Karelian ASSR) Radio Television Station was replacement of the old TRSA-56 television transmitter with a new RTsTA-70 one. The major problem here was minimizing the shutdown time and improvising means for removal of the old antenna and installation of the new one, considering that there were neither enough space nor conventional facilities available for the necessary operations. The old antenna is over 12 m tall and weighs over 800 kg. Corrosion of bolts holding it and its feeder system for over 15 years had to be cut. The new antenna is over 4 m tall and weighs over 250 kg; it and its feeder system had to be mounted on a 45 m high pedestal after complete preassembly in the laboratory. Removal of the old and installation of the new were accomplished with the aid of a helicopter, the entire operation taking only 1.5 hours and costing only 1200 rubles in addition to labor. Figures 4.
[167-2415]

UDC 621.371.11

PROBABILITY DISTRIBUTION DENSITY OF NORMALIZED RADAR RANGE

Moscow RADIOTEKHNIKA in Russian No 2, Feb 84 (manuscript received, after condensation, 17 Jul 83) pp 26-29

MELITITSKIY, V. A., AKINSHIN, N. S. and MIKHAYLOV, A. V.

[Abstract] The normalized radar range $D_n = 4 \sqrt{\sigma_t}^{-2} = D / \sqrt{\Pi}$ (σ_t - effective scattering surface area of target, η^2 - polarization reception coefficient, Π - radar design parameter) and its probability distribution density are evaluated, considering that both σ_t and η^2 fluctuate. The envelopes of orthogonally polarized two components of a nongaussian signal are assumed to have a Nakagami probability distribution density, a more general case than that of $\eta^2 = \text{const}$ and exponential probability distribution density of the

effective scattering surface area. Expressions are derived on this basis sufficiently general for calculating not only the radar range but also the probabilities of correct detection and false alarm in a random reception process. The error of the calculated mean radar range approaches zero as the parameter $m \geq 1/2$ in the Nakagami distribution approaches infinity. Figures 4, references 4: 3 Russian, 1 Western (in Russian translation). [165-2415]

UDC 551.501.85

SPECTRAL WIDTH OF SIGNAL REFLECTED BY MULTIPLE TARGET

Moscow RADIOTEKHNIKA in Russian No 2, Feb 84 (manuscript received, after completion, 12 Apr 83) pp 30-32

MEL'NIKOV, V. M.

[Abstract] The spectral width of the reflected signal from a multiple target is calculated on the basis of its relation to the mean frequency of pips in the output signal of the probing system, considering that direct integration of the experimentally recorded signal spectrum is not feasible. This frequency is defined differently for a pulse output signal than a continuous one, the signal envelope and some reference level being used for the latter. In the case of a pulse output signal, pips in each pulse are counted relative to the preceding pulse and their mean frequency depends on the power correlation coefficient as well as on the signal-to-noise power ratio. Calculations based on these relations tie in with the V. A. Kotel'nikov theorem regarding reconstruction of a function from discrete readings. Experimental measurements of pip frequency in radar signals were made using an MRL-5 radar with a 500-Hz pulse repetition rate and heavy cumulonimbus clouds as targets. Figures 3, references 7: 3 Russian, 4 Western. [165-2415]

UDC 621.396.96

EFFECT OF QUANTIZATION ON EFFICIENCY OF INTERFERENCE COMPENSATOR

Moscow RADIOTEKHNIKA in Russian No 3, Mar 84 (manuscript received, after completion, 14 Nov 83) pp 76-80

GABIDULIN, E. M., LEVSHIN, V. P. and PILIPCHUK, N. I.

[Abstract] The performance of a digital radar interference compensator consisting of a main antenna and several auxiliary antennas is analyzed, with the assumption made that all input signals are narrow-band Gaussian ones and that useful signals in all auxiliary antennas are negligible. Straight optimal linear processing of signals is considered first with respect to

either of the two essentially equivalent criteria: minimum rms error of signal estimation or maximum signal-to-noise ratio, assuming that output signals from different channels are correlated. Next optimal linear processing of signals is considered with a preliminary nonlinear transformation of the vector of the complex output signals. A correlation is allowed to exist between quantization errors and quantized signals as well as between quantization errors in different channels. When quantization of complex signals is performed in each channel independently, and of their real and imaginary parts separately, such quantization increases the rms processing error, but the vectors of weight factors according to the two optimality criteria remain identical to each other. Tables 1, references 5: 2 Russian, 3 Western.
[181-2415]

BROADCASTING/CONSUMER ELECTRONICS

WAYS TO IMPROVE PERFORMANCE OF LOW-POWER TELEVISION RELAY-CONVERTER

Moscow VESTNIK SVYAZI in Russian No 12, Dec 83 pp 20-22

BABUK, G. V., candidate of technical sciences, chief of laboratory, NIIR
[Scientific Research Institute of Radio (?)]

[Abstract] Inspection and surveys indicate that the performance of low-power television relays needs improvement, particularly in the signal-to-noise ratio, for better reception of weak signals in remote areas. The three known methods of achieving this are decreasing the noise factor at the relay output, increasing the gain of the receiver antenna, and increasing the elevation of the latter. Here these methods are analyzed on the basis of theoretical relations. The decrement of signal-to-noise ratio is calculated as a function of the relay noise factor, relative to a "noiseless" relay, and as a function of the download cable length, on which the effective gain also depends. The fact is taken into consideration that the relay noise is principally the noise of its transistors and that replacement of the GT328 transistor in RPNT or RPTDA relays by a KT399A or GT362A transistor should result in a noise reduction by 1.5-2 dB. Subsequent calculations of signal voltage and electric field intensity at relay output and output indicate the effectiveness of noise reducing measures. Theoretical analysis is supported by available data on signal reception, absolute (μV) and relative (dB), in I, II, III, and IV-V frequency bands as well as on the performance characteristics of RK antenna cables. Figures 2, tables 1.
[167-2415]

FIRST STAGE IN COMPLETE MODERNIZATION OF PTsTA-70 TELEVISION RELAY

Moscow VESTNIK SVYAZI in Russian No 12, Dec 83 pp 25-27

FRIDMAN, E. M., chief of Central Laboratory, SHELEPEN', I. V., chief specialist, and CHALENKO, V. L., senior engineer, All-Union Radio-Television Transmitter Station imeni October Semicentennial

[Abstract] The first stage in complete modernization of the RTsTA-70 television relay involves development of a transistorized-integrated video signal correction and stabilization system. Better correction and longer stability than with the existing system are ensured by eliminating the passive phase

corrector from the distribution panel and connecting, instead, a transistorized-integrated module containing four functional components between the distribution panel and the image panel. These components are an active phase corrector, a set of nonlinear correctors, a modulator with "quench"-level feedback, and a power supply. Video signals proceed from the distribution panel to the regulator of an automatic control system with variable transfer ratio, and then from there to linear and nonlinear correctors. The active phase corrector, differential-phase corrector, differential-gain corrector, and non-linear-distortion correctors are built with conventional circuitry. The modulator includes precorrection, automatic amplitude regulation of synchronizing pulses with controlled overmodulation limiter and emitter follower, restoration with another emitter follower, and a clamping switch. The feedback signal passes through the limiter and an active filter. Interference immunity of the correction and stabilization system is provided by an automatic control system with automatic selection of automatic or manual operating mode depending on presence or absence of "white"-reference pulse in the television input signal. All components are mounted on six vertical boards, one independent set of three for each of the two transmitters. The next stage in complete modernization of the RTsTA-70 television relay will be transistorization of the image preamplifier. Figures 4, tables 1.
[167-2415]

UDC 621.394.62:621.396.029.7

REGENERATORS OF BINARY PULSES FOR OPTICAL COMMUNICATION SYSTEMS

Moscow RADIOTEKHNIKA in Russian No 2, Feb 84 (manuscript received after condensation, 6 Oct 83) pp 3-8

POROKHOV, O. N.

[Abstract] Regenerators of binary pulses are considered for optical communication systems, taking into account the particular characteristics of binary data transmission over optical cables in the primary network of the Unified Automated USSR Communication System as well as the various forms of binary pulse signals (pulse-keyed) and the various methods of their reception now in use worldwide. Linear filtration, optimally with zero threshold, or time filtration of signals for extraction of binary pulses from noise of any origin (mainly shot or thermal) and with any distribution (mainly normal or Poisson) is proposed as a means of ensuring high interference immunity and reliability of these regenerators. An additional advantage is the possibility of error monitoring without shutdown of communication. It is also possible to maximize the range of regenerator effectiveness, i.e., the distance between regenerators necessary for attaining the ultimate interference immunity level of optical communication over cables or over atmospheric and space channels. Figures 3, references 33: 23 Russian, 10 Western (1 in Russian translation).
[165-2415]

FORMATION OF POLYPHASE SIGNALS

Moscow RADIOTEKHNIKA in Russian No 2, Feb 84 (manuscript received, after completion, 8 Jul 83) pp 34-38

MATYUSHIN, O. T. and SYROMYATNIKOV, A. N.

[Abstract] Polyphase signals with ideal autocorrelation functions are considered for resolution over a wide dynamic range. A generator of such signals consists of two storing adders in series, a decoder tapped in between them, a carrier-signal generator, a clock-signal generator, and a code-to-phase converter as output stage, the latter consisting of a code converter, two digital-to-analog converters, two multipliers, one adder, and one 90° phase shifter. While ideal autocorrelation functions have zero side lobes, formation of polyphase signals by such a radioelectronic generator involves some error. This error is estimated here in terms of mean-square deviations from an ideal signal and from an ideal autocorrelation function. Envelopes and discrete spectra of signals are taken into consideration, the autocorrelation function being regarded as the result of signal compression by a matched filter. The maximum level and the upper bound of its side lobes are calculated on this basis. The principal nonidealities of the generator, namely inaccuracy of signal resolution into quadrature components, of multiplication, of 90° phase shifting, of addition of products, and the sluggishness of all circuit components are each evaluated separately, their combined effect being very difficult to determine. Figures 2, references 7: 5 Russian, 2 Western.
[165-2415]

UDC 621.372.632.001

LOGIC METHOD OF PHASE-TO-SINE CONVERSION IN DIGITAL FREQUENCY SYNTHESIZERS

Moscow RADIOTEKHNIKA in Russian No 2, Feb 84 (manuscript received, after condensation, 11 Jun 83) pp 50-54

POBEREZHSKIY, Ye. S. and SOKOLOVSKIY, M. N.

[Abstract] Direct multilevel digital synthesis of frequency arrays with subsequent digital-to-analog conversion of readings and with stable intervals between readings is considered, using the more general logic method rather than stored sine tables or series expansions of the sine or combining both. The structure of such a frequency synthesizer includes a reference generator used for producing stable intervals, a clock-frequency generator, a storing device, and a phase-to-sine converter, the latter consisting of a phase code complemeter, a one-quadrant converter, and a sine sign adder. The digital-to-analog converter is followed by a low-pass filter. One can optimize the

one-quadrant converter, especially when it is designed for large-scale integration, by minimizing the depth of the logic structure in terms of number of elements and interconnections so as to also improve the interference immunity and increase the speed, with attendant avoidance of duplication and reduction of power requirement. This is demonstrated in accordance with Boolean algebra, using disjunctive or conjunctive normal forms. Figures 2, references 6: 5 Russian (1 items on foreign radioelectronics), 1 Western (in Russian translation).
[165-2415]

UDC 621.391.827.25

FEASIBILITY OF REDUCING LEVEL OF SOME PARASITIC OSCILLATION MODES IN WIDEBAND VHF POWER AMPLIFIERS

Moscow RADIOTEKHNIKA in Russian No 2, Feb 84 (manuscript received 14 Mar 83)
pp 86-89

BURKOV, I. A. and TRUKHIN, N. A.

[Abstract] The feasibility of reducing the level of harmonic and intermodulation oscillations in wideband transmitter power amplifiers with transistor stages is examined on the basis of the phase characteristics of devices used for power compounding. The analysis is made for a typical bridge circuit containing two amplifiers with different gains, a power divider, and a power adder in the four arms, respectively. The latter two devices are cophasal ones, each characterized by a frequency-dependent transmission coefficient, with a phase shift between them. Calculations based on theoretical relations and data on a pair of ultrashort-wave amplifiers with KP 909 field-effect transistors indicate that, with a summing circuit consisting of 3-dB directional couplers, it is possible to reduce the intermodulation component of interference by an additional amount up to 25 dB, depending on the operating frequency range. Figures 4, tables 1, references: 2 Russian.
[165-2415]

UDC 621.396.62

EFFECT OF STRONG HARMONIC INTERFERENCE ON F-M RADIO RECEIVER

Moscow RADIOTEKHNIKA in Russian No 2, Feb 84 (manuscript received, after condensation, 10 Jun 83) pp 89-90

MOVSHOVICH, M. Ye. and AL'TER, L. Sh.

[Abstract] The effect of a strong harmonic input interference on the signal-to-noise ratio at the output of an FM radio receiver is evaluated, assuming an amplitude-limited useful signal, an output interference produced principally

by noise sources in the r-f channel and measured with no modulation of the carrier signal, no interference entering the i-f channel, and a useful signal sufficiently weak for it and the noise to be influenced by the interference independently. The results indicate that the output signal-to-noise ratio decreases upon appearance of a strong harmonic input interference, but can be restored by a larger amplitude of the signal carrier and will remain constant when an increase of the interference amplitude is accompanied by a large increase of the signal amplitude. The method of analysis yields analogous results when extended to two strong harmonic input interference signals entering the r-f channel, but not the main receiver channel. References 11: 10 Russian, 1 Western (in Russian translation).
[165-2415]

UDC 621.397.61:681.772.7]:621.397.132

COLOR TELEVISION CAMERA

Moscow TEKHNIKA KINO I TELEVIDENIYA in Russian No 3, Mar 84 pp 3-9

KANDALINSKIY, V. V. and ROZVAL, Ya. B., All-Union Scientific Research Institute of Television and Radio Engineering

[Abstract] The new KT-312 color television camera is a multipurpose device, for use with mobile news reporting television stations as well as in studios and independently with any sound recorder or radio link. Structurally it is similar to a TTV 1603 camera and in performance it matches both MARK 1XP and TTV 1525 camera. Its five main components in a single module are a video signal shaper, a video signal processor, an automatic tuner, a synchronizer with monitor and controls, and a power supply. The video signal shaper includes an OTsT 10x14 objective with 10:1 adjustable focal length and 1:1.8 adjustable aperture, a four-part light splitting prism with interferential mirror coating and with semitransparent coating for interfacing the diaprojector to the three (Red, Green, Blue) channels, three transmitter tubes with horizontal and vertical sweep, correction for geometrical variance between screens, and three video preamplifiers with special means of noise suppression. The video signal processor includes an aperture corrector with comb filter, a corrective signal generator, and a SECAM encoder. Operation of the automatic tuner is based on seeking the minimum incompatibility so as to be immune to positional and gain chromatism aberrations. The camera with view finder on the portable stand weighs 86 kg, not including the objective. It is powered from a 12⁺⁵v d.c. battery through a 15 m long cable with an A-312 adapter or through a 15-100-300 m long cable and a PDU-312 adapter, drawing 48 W and requiring less than 30 s warmup time. Figures 7.
[180-2415]

MEASUREMENT OF NONLINEAR DISTORTIONS IN DIGITAL SOUND RECORDING AND PLAYBACK EQUIPMENT

Moscow TEKHNKA KINO I TELEVIDENIYA in Russian No 3, Mar 84 pp 10-13

VANYUSHKIN, O. V. and SEMENOV, O. B.

[Abstract] Even a harmonic signal at the input of the analog-to-digital converter generally appears to be accompanied by a quasi-noise component with a continuous spectrum at the output of the digital-to-analog converter in digital sound recording and playback equipment. Although time discretization is a linear process, level quantization is a nonlinear one. The quantizer is thus the major source of nonlinear distortions, which largely determine the performance and the grade of such equipment. Here the characteristics of a quantizer, typically a 16-level one, are analyzed for a quantitative evaluation of these distortions. The nonlinear distortion factor of the output signal is defined and calculated on the basis of a sinusoidal input signal, assuming a signal-to-distortion ratio equal to the signal-to-noise ratio. Although the spectral method of measuring the nonlinear distortions is not generally applicable here, considering that the amplitude-frequency characteristic is flat up to very high harmonics, it is still possible to use this method under certain conditions. It is necessary to discretize the distortion spectrum to several frequencies only, which can be achieved with specific ratios of the input signal frequency f_0 to the signal discretization frequency f_s . Experiments have confirmed the feasibility of this concept. Measurements were made with two sine-wave generators synchronized at a reference frequency, a Brüel & Kjoer 7502 recording instrument, and a Sony PCM-100 processor. With $f_0/f_s = p/g$ (p, g - integers), the spectrum of the output signal and thus the spectrum of nonlinear distortions in the digital system were, indeed, found to be line spectra containing only components at frequencies $0, f_0/g, 2f_0/g, \dots, 1/2pf_0/g$. Figures 4, references 7: 4 Russian, 3 Western (all in Russian translation).
[180-2415]

UDC 771.44:778.534

LIGHTING EQUIPMENT FOR SPECIAL FILMING

Moscow TEKHNKA KINO I TELEVIDENIYA in Russian No 3, Mar 84 pp 14-18

ALFIMOVA, N. V., KURITSYN, A. M., OSKOLKOV, I. N. and POKHITONOV, Yu. P.,
All-Union Scientific Research Institute of Cinematography

[Abstract] A broad range of special-purpose lighting equipment is being developed and made available for filming artistic, scientific, medical, technical, or other special objects. They combine high efficiency and high picture quality with spectral characteristics matching the photographic film

material. The main common requirements are: short path of light beam formation, high illuminance in the plane of the object, smooth regulation of illuminance within the light spot and of angular dimensions without distortion of the spectrum, entrapment of thermal radiation without loss of light intensity, small size and weight. These special-purpose lamps fall generally into four application groups. Lamps for special macroscopic filming are the KOS-3000 (3.6 kW) shadeless ring lamp with interference-type reflectors and scatterers, and the OPM-250 (0.25 kW) with appropriate optics and controls, both using KGM light sources. Lamps for endoscopic filming are the series OS-75/100/250 using KGM light sources and optical fibers. Lamps for microscopic filming are the series OI-18/19/24 using incandescent light sources. Lamps for filming in ultraviolet light are the OPU and the OKUF-5M, both using mercury-arc quartz tubes as light sources. These special-purpose lamps will replace the less efficient or otherwise inadequate for special filming general-purpose lamps "Zarya"-150/500 giving directional light and "Svet"-500/100M, "Blik"-100/300, "Luch"-300/300M/500 giving directional-diffuse light. Figures 4, tables 2, references 9: 8 Russian, 1 Western (in Russian translation).

[180-2415]

UDC 771.531.35.023.415.24

INFECTIIONAL FILM DEVELOPMENT

Moscow TEKHNIKA KINO I TELEVIDENIYA in Russian No 3, Mar 84 pp 19-27

RED'KO, A. V., Leningrad Institute of Cinematography Engineers

[Abstract] Infectiional development of photographic substances by the "fogging" effect or by the "lith" acceleration mechanism is reviewed from the standpoint of preferential chemical reactions with attendant changes in molecular structure, concentration kinetics and radical formation kinetics, optimum developer formulation, and exposure time as well as processing time characteristics. Effectiveness and speed of developers are evaluated in terms of optical density and gamma depending on the concentrations of reagents and catalysts as well as on the pH-factor of the solution. An analysis of available data indicates that the "lith" mechanism performs better than the "fogging" effect, especially in the light its electrochemical interpretation. Figures 10, tables 4, references 35: 4 Russian, 31 Western (1 in Russian translation).

[180-2415]

EVALUATION OF REWINDERS NOW IN USE

Moscow TEKHNKA KINO I TELEVIDENIYA in Russian No 3, Mar 84 pp 33-36

DENISOV, I. G. and LEVITIN, G. V., Leningrad Institute of Cinematography Engineers

[Abstracts] The performance of 35P-5-M and 70P-6 rewinders, for 35 mm and 70 mm film tapes, respectively, was evaluated in a laboratory experiment. A special test stand had been designed and built for the purpose of determining the dependence of tension and instantaneous velocity on the reel diameter from simultaneous velocity and force measurements, as well as for determining the total rewind time and the slip of layers on the reel. The velocity was measured with a transducer consisting of a photodiode and an incandescent lamp, the perforated side track on the film tape serving as light modulator and output signals from the photodiode being transmitted, after amplification, to a frequency meter. The force was measured with a semiconductor bridge of tensoresistors. Tests were performed with a dynamometer and a controllable brake. In one test the friction coefficient was determined with the film material on standard flexible substrates ANSI/ASTMD 1894-78 and DIN 53375. In another test, slip was determined on an inclined plane according to the ISO DP 5769 standard. An evaluation of the data reveals a few deficiencies of these rewinders: jerking start with occasional tearing of the film tape, awkward construction and excessive weight of the interlock, inadequacy of transverse guide rollers, and a high noise level. Excessive slip causes wear, and overcoming this problem requires a proper reel redesign. The limiting curve of tension versus reel radius indicates the conditions for slipless rewinding. The life of the master film tape can be extended by minimizing the number of rewinds. Figures 8, references 4: 3 Russian, 1 Western.

[180-2415]

UDC 778.23:778.55

IMPROVEMENT OF CONTACT-TYPE TAPPER FOR FILM COPY PRINTERS

Moscow TEKHNKA KINO I TELEVIDENIYA in Russian No 3, Mar 84 pp 37-39

VALUYSKIY, B. V., VORONOV, N. I. and CHESNOKOV, V. N., All-Union Scientific Research Institute of Cinematography; Central Design Office of Cinematography, "Ekran" Scientific-Industrial Association

[Abstract] A new contact-type tapper for film copy printers has been developed without the deficiencies of existing ones with the roller axle either perpendicular or parallel to the plane of the photographic film. The film tape with crosscuts envelopes the support drum and the tapper roller at the end of one lever arm is pressed against the film tape by a spring at the end

of the other lever arm, the lever beam being free to oscillate on an axle through its center. Lever, roller, and drum are each mounted on an axle through a bushing, the drum axle and the lever axle being mounted on a plate of an electrically nonconducting material. The taper contractors are connected to both axles, also to a servo electromagnet and an automatic exposure regulator through an electronic circuit. This circuit closes during passage of a crosscut through the rig and opens between crosscuts. It includes NAND diode logic on series K561 microchips and a KT812A or KT840A power transistor capable of switching currents of 5-8 A and drawing less than a microampere from a 400 V power supply. The taper requires no movable adjustable contactors, which contributes to its high reliability and to low wear of crosscuts. It can operate at printing speeds as high as 3600 m/h with at least 18 frames laid out on a 16 mm film tape. Figures 4, references: 5 Russian.
[180-2415]

UDC 621.385.832.564.4

LI475 VIDICON OF 18 mm DIAMETER WITH ELECTROSTATIC FOCUSING AND MAGNETIC DEFLECTION

Moscow TEKHNIKA KINO I TELEVIDENIYA in Russian No 3, Mar 84 pp 40-43

LAPUK, A. G. and NEKH, G. A.

[Abstract] The new LI475 vidicon with an 18 mm diameter has a resolution comparable with that of existing 26 mm vidicons and uses similar beam controls. The target material is a photoconductive film based on SbS_3 . Its basic electrical operating characteristics are 6.3 V filament supply, 300 V plate supply, 500 V grid supply, 35-55 V across the focusing electrodes, diameter of the deflection ring 35 mm, magnetic line deflection with 4.4 ohm - 0.9 μ H coils and magnetic frame deflection with 145 ohm - 25 mH coils. Its performance characteristics have been measured and evaluated. They include the dependence of the signal current and the dark current on the signal plate voltage at typical target luminance levels, current-luminance curves corresponding to typical dark current levels, the dependence of the signal plate voltage on the target luminance at typical d.c. signal current levels, aperture and modulation characteristics, the dependence of the residual signal on the readout time, on the target luminance, and on the signal current at typical dark current levels, as well as the sensitivity spectrum peaking within the 400-700 nm range of wavelengths and the temperature dependence of the signal current, the dark current, the residual signal, and the signal plate voltage. Figures 11, references: 1 Russian.
[180-2415]

DEPENDENCE OF ABSOLUTE ERROR IN MEASUREMENT OF CHROMATICITY COORDINATES ON SPECTRAL SENSITIVITY CHARACTERISTIC OF SILICON PHOTODIODE

Moscow TEKHNIKA KINO I TELEVIDENIYA in Russian No 3, Mar 84 pp 47-49

IVANOV, V. G., SYSOYEVA, Ye. N. and BEREZINA, M. A., Moscow Scientific Research Institute of Television

[Abstract] Measuring the chromaticity coordinates of reference light filters with a photodiode is considered, such filters being used in colorimeters for inspection of color kinescope screens. The absolute error of this measurement is evaluated, of specific concern being its dependence on the spectral sensitivity characteristic of the photodiode. Theoretical calculations for an FD-24K silicon photodiode, with an approximately linear characteristic over the visible range, are supplemented with experimental data on the variation of the chromaticity coordinates of such light filters in a KTTs-5.048 colorimeter. These variations include a drift zone corresponding to a shift of the blue-to-red sensitivity ratio from 0.6 to 0.9, with all other sources of colorimeter error disregarded. A subsequent evaluation of experimental data has revealed that the distribution of the absolute colorimeter error does not change with changing magnitude of the photodiode drift. Figures 4, references: 5 Russian. [180-2415]

DIGITAL PROCESSING OF SIGNALS

Moscow RADIOTEKHNIKA in Russian No 3, Mar 84 pp 6-10

VARAKIN, L. Ye.

[Abstract] Digital processing of signals involves discretization in time, according to the Kotel'nikov theorem, and quantization of levels. The discretization frequency must be equal to at least double the width of the signal spectrum, and the finite number of quantization levels depends on the required fidelity. With a number assigned to each level, digital processing of signals reduces to processing of numbers, binary numbers being most expedient for this purpose. The essential equipment for digital processing of signals are analog-to-digital and digital-to-analog converters, followed by digital filters optimally extracting signals from noise and interference, digital matched filters maximizing the signal-to-interference ratio, arithmetical logic performing additions and multiplications, and general-purpose or special-purpose microprocessors. The advantages of digital processing are high interference immunity and low error level, ensured accuracy and ideal reproducibility, high immunity against instability of transmission channel parameters, high reliability and high stability of digital processing equipment, attainability of high processing speeds through operation of identical

devices in parallel, and feasibility of large-scale and very-large-scale integration with resulting high technical and economic indicators. The disadvantages of digital processing are that higher accuracy requires higher speed and thus wider transmission channels, that the number of operations increases proportionally to the word length squared, and that equipment cost as well as energy consumption increase with higher processing speed. In radio communication, specifically, digital modulation methods such as pulse-code modulation are fairly well established. One problem here is ensuring electromagnetic compatibility with other coexisting radio communication systems. Transition from frequency modulation to digital modulation has been made feasible by combining the honeycomb principle of hardware design with the use of pseudonoise signals. Another problem here is reducing the complexity of equipment, which can be accomplished by replacing "straight" algorithms with "fast" ones such as fast Fourier and Walsh transformations. Digital processing of voice signals involves either separate or combined speech analysis and speech synthesis, applications being many and ranging from telephone communication to personal "electronic secretaries". Digital processing of pictures is widely used in aerospace research and in satellite communication systems as well as in industrial robotics. Other areas where digital processing of signals has been introduced include navigation and radar. The tremendous recent progress in digital processing is attributable to developments in microelectronics as well as to the relative facility of signal extraction with adequate suppression of noise, interference, and distortions. Further progress will be determined by developments in optoelectronics, by use of charge-coupled devices, and by invention of new devices. References: 4 Western (2 in Russian translation). [181-2415]

UDC 621.397.2.037.372

INFORMATION PROBLEMS IN DIGITAL TELEVISION

Moscow RADIOTEKHNIKA in Russian No 3, Mar 84 (manuscript received 28 Oct 83)
pp 10-15

TSUKKERMAN, I. I.

[Abstract] Problems involved in current transition from analog to digital television broadcasting, particularly information problems, are reviewed and analyzed from the standpoint of performance optimization. Foremost among them is the analog-to-digital conversion of a continuous video signal. Binary coding has been selected for this purpose, with a discretization frequency approximately equal to double the width of the signal spectrum (12 MHz in both European SECAM and PAL systems) and with at least $2^7 = 128$ quantization levels, well above the eye's persistence threshold. In color television the discretization frequency has been raised to 13.5 MHz and the number of quantization levels to $2^8 = 256$, which yields a total digital signal flux of 216 Mbit/s. In accordance with the statistical characteristics of television images, taking into account the mobility of objects and the

corresponding entropy of the brightness distribution, there arise the problems of code selection and generalized quantization to meet the information processing characteristics of the optical system. The next two interrelated problems are minimizing the digital signal flux without degrading the picture quality and increasing the interference immunity. It is possible to reduce the digital signal flux by differential pulse-code modulation with a nonlinear quantization scale, and with prediction of the modulation law within each frame as well as from frame to frame, also by various methods of adaptive group coding. It is possible to increase the interference immunity by digital storage in a memory, with calculation of the interframe brightness difference and subsequent summation of signals. Redundancy is an important factor here, determined directly by the statistics of images and indirectly by the psychophysiology of vision, sufficient redundancy being needed for adequate interference immunity while decreasing it is the best way to reduce the digital signal flux. References 4: 2 Russian, 2 Western (both in Russian translation).

[181-2415]

UDC 621.396.96:621.391.26

TECHNICAL AND ECONOMIC OPTIMIZATION OF DIGITAL SIGNAL PROCESSING SYSTEMS

Moscow RADIOTEKHNIKA in Russian No 3, Mar 84 (manuscript received, after completion, 29 Aug 83) pp 25-27

BAKULEV, P. A., POPOV, D. I. and KOSHELEV, V. I.

[Abstract] Design optimization of digital processing systems for Gaussian signals submerged in Gaussian interference is considered with respect to a combination technical and economic criterion. As such a criterion has been selected complexity of the processing system. This system most generally consists of an array of analog-to-digital converters followed by single-channel m -order band elimination filters and then a multichannel band pass filter, the latter feeding into individual channels containing each a quadrature joiner followed by a threshold device. The vector of weight factors corresponding to such a cascading of linear filters for a signal consisting of n pulses is n -dimensional and the order of the multichannel bandpass filter accordingly is $n - m - 1$. Optimization is based on applying the minimum principle to complexity and the maximum principle to the signal-to-(interference+noise) ratio as an efficiency indicator. An analysis of a typical system thus optimized reveals that a multichannel bandpass filter along is most economical when efficiency is not critical and addition of band-rejection filters becomes almost as economical when efficiency is critical. With band-elimination filters alone it is not possible to increase the efficiency by increasing the complexity, but with band-elimination filters and bandpass filter the efficiency increases with increasing complexity in a functional relation. Figures 2, references 5: 4 Russian, 1 Western (in Russian translation).

[181-2415]

INTERFERENCE IMMUNITY OF POLYPHASE DEMODULATOR WITH IDEAL CLASSIFIER

Moscow RADIOTEKHNIKA in Russian No 3, Mar 84 (manuscript received, after abridgment, 1 Nov 83) pp 28-29

PETROVICH, N. T. and RASKIN, V. K.

[Abstract] The interference immunity of a parallel-type polyphase demodulator for signals with single relative-phase keying is estimated, assuming that the polyphase generator of reference oscillations coherent with the signal in the demodulator channels feeds into an ideal classifier and that at the input of this generator there appears, together with the signal, an additive stationary white Gaussian noise. The dependence of the error probability on the ratio of signal energy to spectral noise density, with the number of phases (parallel channels) as a variable parameter, indicates that, with a sufficiently large number of channels simultaneously synchronized relative to the carrier, such a demodulator is suitable for intermittent communication requiring a high interference immunity and a short synchronization time. Figures 3; references 7: 5 Russian, 2 Western (in Russian translation).
[181-2415]

INTERFERENCE IMMUNITY OF DIGITAL EQUIPMENT FOR COHERENT PROCESSING OF WIDEBAND SIGNALS

Moscow RADIOTEKHNIKA in Russian No 3, Mar 84 (manuscript received, after completion, 28 Nov 83) pp 30-34

OBRAZTSOV, A. V. and IGNATOV, V. V.

[Abstract] The interference immunity of discrete data transmission systems using large-base quasi-noise signals obtained by pseudorandom-sequence phase or frequency keying of the carrier and processing such signals "in the large" by means of discrete matched filters is estimated for systems with a cross-correlational demodulator and an autocorrelational demodulator, respectively. The crosscorrelational demodulator consists of three analog-to-digital converters operating by the linear delta-modulation method, two coincidence circuits, two reversible counters acting as digital integrators, and a threshold device. The autocorrelational demodulator consists of one analog-to-digital converter, a digital delay line, one coincidence circuit, one reversible counter, and a threshold device. Calculations and analysis reveal that, owing to analog-to-digital conversion by the linear delta-modulation method, the interference immunity of both demodulators approaches the maximum attainable as the discretization frequency is increased to a large multiple of the highest frequency in the signal spectrum. A crosscorrelational demodulator generally has a higher interference immunity than an autocorrelational

one, the interference immunity of both depending largely on the selected signal base. Beyond a certain width of the signal base, however, a further increase of the width will not result in a significant decrease of the detection error probability. The energy losses in both digital demodulators are higher than in theoretically optimum analog ones. Figures 4, references 10: 8 Russian, 2 Western (both in Russian translation).
[181-2415]

UDC 621.396.62:681.325.3

DIGITAL RADIO RECEIVERS AND PROBLEMS OF ANALOG-TO-DIGITAL CONVERSION OF NARROW-BAND SIGNALS

Moscow RADIOTEKHNIKA in Russian No 3, Mar 84 (manuscript received 2 Aug 83)
pp 56-63

POBEREZHSKIY, Ye. S.

[Abstract] Four methods of analog-to-digital conversion in digital radio receivers are described, considering that an additive mixture of signal and interference at the input of such a receiver is usually a narrow-band process. All four methods utilize the quasi-harmonic form of narrow-band oscillations. The first method is based on resolving the input process into two components in quadrature. The second method is based on representing the input process as a set of envelope reading and phase reading pairs, readings taken at a discretization frequency determined by the width of the signal spectrum and taken at low oscillation levels. The third method is based on sampling (strobing) over a time interval which, while only a fraction of $1/f_0$ (f_0 - center frequency of the input signal), can be made sufficiently long to reduce integrator and memory requirements. The fourth method is based on quantization with prediction and use of redundancy for widening the dynamic range of the digital channel in the receiver. The applicability of each method is determined by its systematic error, analysis and calculation of which indicate the limitations of each method. The second method, called microlevel analog-to-digital conversion, is of particular interest because of possible modifications which can make it more effective. Such modifications are: 1) analog differentiation of the signal with subsequent conversion of the maximum of the derivative nearest to the triggering pulse to digital form; 2) measurement and analog-to-digital conversion of the instantaneous signal value at a point lagging behind the triggering pulse by a fixed time much smaller than $1/f_0$; 3) integration of the signal over such a lag time and analog-to-digital conversion of the integral; 4) measurement of the dwell time Δt_1 of the signal zero-crossover during the change of voltage from $-V_1^*$ to $+V_1^*$ (V_1^* - sufficiently low threshold voltage level). Figures 2, references 14: 9 Russian, 5 Western (1 in Russian translation).
[181-2415]

SPECTRAL CHARACTERISTICS OF DIGITAL FREQUENCY SYNTHESIZERS

Moscow RADIOTEKHNIKA in Russian No 3, Mar 84 (manuscript received 7 Jun 83)
pp 69-74

SHAKHGIL'DYAN, V. V. and LUCHKOV, V. G.

[Abstract] A digital frequency synthesizer is considered which successively converts the frequency code to a phase code, the phase code to a Walsh function, and the Walsh function in a special digital-to-analog converter with a low-pass filter to an analog signal. A read-only memory can be used, instead of a logic microcircuit array, for converting phase codes to Walsh functions. This is demonstrated by synthesis of a sinusoidal signal using an $N \times N$ Walsh matrix and a digital-to-analog converter with R positions. The interference immunity of such a synthesizer with finite signal determination time depends on its spectral characteristics, which are determined by the rounding error. A relation is established between the spectrum of a rounding synthesizer and the spectrum of an exact synthesizer, the frequencies of the spectrum components being the same for both, when the frequency of the output signal is 2^n ($n = 1, 2, \dots$). Analysis and calculation reveal how changes in the synthesizer parameters N and R affect the synthesizer spectrum, when even harmonics will disappear and when rounding "noise" will become negligible. Figures 6, references: 4 Russian (one item on foreign electronics).
[181-2415]

UDC 621.373.187.4:681.32

SPECTRAL CHARACTERISTICS OF DIGITAL MULTILEVEL-SIGNAL SYNTHESIZERS

Moscow RADIOTEKHNIKA in Russian No 3, Mar 84 (manuscript received 11 Sep 83)
pp 74-76

SHISHOV, S. Ya. and YAMPURIN, N. P.

[Abstract] A computer-type digital synthesizer of multilevel signals is considered which consists of a digital phase accumulator, a read-only memory, a digital-to-analog converter, and a low-pass filter. Its basic parameters are: size of phase accumulator R , number of phase quantization levels N_ϕ , number of amplitude quantization levels N_a , and code K of the frequency to be synthesized. The spectral characteristics of such a synthesizer are calculated by expanding each pulse within the quasi-sinusoidal converter output signal into a Fourier series. The results reveal how the magnitude of interference depends on the numbers of phase and amplitude quantization levels, depending on the code size K . When $K \leq 2R/N_\phi$, then the relative magnitude of the largest parasitic component in the spectrum does not depend on N but decreases with increasing N_a . When $K > 2R/N_\phi$, then the relative

magnitude of the largest parasitic component decreases with increasing N and with increasing N_a , and the number of parasitic components increases with increasing K . Figures 3, references 4: 3 Russian, 1 Western (in Russian translation).
[181-2415]

UDC 621.391.1

SIMPLE IMPLEMENTATION OF ADAPTIVE QUANTIZATION

Moscow RADIOTEKHNIKA in Russian No 3, Mar 84 (manuscript received 12 Oct 83)
pp 80-83

LARIN, A. L. and PILIPCHUK, N. I.

[Abstract] Devices for adaptive pulse-code modulation with least complexity are one-parametric and two-parametric adaptive quantizers. Both are based on analog-to-digital conversion, also a generator of starting and clocking pulses AND logic with triggers, and a digital-to-analog converter. The one-parametric adaptive quantizer, with adjustable range, contains a distributor behind the generator, a comparator behind the digital-to-analog converter, OR logic behind the AND logic, and a reversible counter. The two-parametric adaptive quantizer, with synchronous range and step adjustment, uses the digital-to-analog converter preceded by a reversible counter as a generator of the reference voltage, with AND logic and NOT logic in parallel between the reversible counter and the analog-to-digital converter. Operation with codes of different lengths requires addition of buffer devices on both transmitter and receiver sides. Figures 3, references 5: 4 Russian, 1 Western.
[181-2415]

UDC 681.3.352

ASYNCHRONOUS CASCADE-TYPE ANALOG-TO-DIGITAL CONVERTER OPERATING IN GRAY CODE

Moscow RADIOTEKHNIKA in Russian No 3, Mar 84 (manuscript received 26 Oct 83)
pp 83-86

PSURTSEV, V. P.

[Abstract] An asynchronous cascade-type analog-to-digital converter operating in the Gray code is considered, the characteristic feature of this code being that in it any two adjacent number differ by only one digit. The error of such a device is analyzed on the basis of the rule of Gray code formation and the converter logic. The error of signal estimates is found to depend not only on the discreteness of the readout and on the error of the reference but also on the imprecision of hardware characteristics, specifically the gain

error in each stage. The converter error is calculated for the worst case, where the gain errors in all stages are equal and on the same side. The upper limit for the absolute value of gain errors is established accordingly, $|\delta_G| < 1/m^2$ (m- number of digits and stages), below which the converter error will not exceed on unit of the lowest digit. Figures 2, references 3: 2 Russian, 1 Western.
[181-2415]

UDC 621.3.029.5/6

COMPLEX CRITERION EVALUATION OF EFFECTIVENESS OF USE OF RADIO FREQUENCIES
BY RADIO SYSTEMS WITH BROADENED SIGNAL SPECTRUM

Moscow ELEKTROSVYAZ' in Russian No 4, Apr 84 (manuscript received 27 Jun 83)
pp 16-18

VINOGRADOV, N. V. (deceased)

[Abstract] The effectiveness of use of radio frequencies by radio systems with noiselike signals is evaluated. In the International Radio Consultive Committee, these systems are designated as "radio systems with a broadened signal spectrum (RSRS). They have been investigated theoretically in two Soviet reports. The field of radio frequencies assigned to RSRS substantially increases the frequency band of radio systems with simple signals (RSPS) during transmission of the same information. Consequently, it is possible to assume that RSRS uses radio frequencies less effectively than RSPS. Along with this, there is confirmation that one of the methods for increasing the effectiveness of use of radio frequencies is the use of noiselike signals and code separation of radio channels. With the assistance of a complex criterion, the present paper compares the effectiveness of use of the RSRS and RSPS radio frequencies. A method is proposed for evaluation of the effectiveness of use of radio frequencies by radio systems, which does not require determination of a standard radio system; it connects together two important systems of indices, which ordinarily are considered separately-- specific expenditure of band and energy on signal transmission; exhibit degree of effect on indicated effectiveness of each of many factors, Figures 2, references 13: 8 Russian, 2 Western.
[238-6415]

UDC 621.391:621.395.7

IDENTIFICATION OF VOCAL COMMANDS FOR CONTROL OF TELEPHONE DIALING BY VOICE

Moscow ELEKTROSVYAZ' in Russian No 4, Apr 84 (manuscript received 21 Jul 82)
pp 45-48

KUZNETSOV, P. G., NIKIFOROVA, N. M., POZDEYEV, V. S. and KHATBULLIN, R. A.

[Abstract] Devices controlled by voice are necessary in order to increase efficiency of the operating control of machines and mechanisms, and the creation of automatic information-reference services. The dictionary for such

devices contains tens and even hundreds of words, and the structure of the proposition is rigidly fixed. For realization of the devices it is necessary to solve the problem of automated identification of speech. In the telephone dialing controlled by voice discussed in the paper, the dictionary consists of digits and several auxiliary words. The problem is conditionally solved in two basic stages: selection of a system of signs describing a speech signal (SS), and selection of a computing rule. Two systems chosen for investigation of the SS are described and the method of testing them is considered, both in some detail. A test model of a telephone dial, in a condition close to real showed that the announcers sufficiently rapidly adapt to the device, i.e., develop such a manner of pronunciation in which errors of identification are minimal. The time of adaptation amounts to 1-3 days. Tables 5, references: 6 Russian.
[238-6415]

UDC 621.391.037

EVALUATION OF PRECISION OF CALCULATIONS OF SPEECH SIGNAL PARAMETERS FOR FORECASTING VOCODERS

Moscow ELEKTROSVYAZ' in Russian No 4, Apr 84 (manuscript received 2 Nov 82)
pp 48-51

KOZHUKHOVSKAYA, I. A.

[Abstract] The paper considers a model of a forecasting vocoder, in which coefficients of partial correlation are used as the parameters which describe the transfer function of the articulation apparatus. Synthesis of a voice signal is accomplished by a stepped circuit with one multiplier at each step. It is possible to increase the high-speed response and efficiency of a vocoder by a reduction of the precision of computing and the choice of a simpler method of performing operation, in the case discussed here by a choice of operations with a fixed point, which as a rule are fulfilled more rapidly than in operations with a floating point. The principles of linear forecasting, the criterion for evaluation of the prevision of computations, and the range of change of variables are considered. Results of the experiment are presented at length. Tables 3, references: 5 Western.
[238-6415]

UDC 621.397.837

NORMALIZING AND CONTROL OF PARAMETERS OF COMPLETE PATH OF COLOR TELEVISION BROADCASTING

Moscow ELEKTROSVYAZ' in Russian No 4, Apr 84 (manuscript received 6 Jun 83)
pp 52-55

DERYUGIN, N. G.

[Abstract] The principal characteristic of the operation of a complete path for color television broadcasting (CTB) "from light to light," is the quality of the television image at its output. It depends on the parameters of the

system of color television, which assures obtaining the so-called subjective fidelity of light reproduction. The parameters of the equipment realizing the system of color television also have an effect on the quality of the television image. The complete path is presented for a CTB divided into three independent parts, for each of which normalizing and thorough control of the parameters must be accomplished. A statement with regard to this is presented. In addition, special features of control of the performance of the complete circuit of a CTB, with respect to sections, is discussed. It is concluded that existing normalizing and control of the parameters of the individual sections of the complete path of CTB cannot guarantee high quality television broadcasting and require a provision for a television network of expensive measuring equipment. The measuring equipment switched on in series in the transmission circuit of a complete color television signal inevitably introduces a distortion, reduces the reliability of operation of the circuit, as well as creates an uncontrolled transmission circuit for a complete color television signal. It is assumed that the selection of three parts, notably light-signal, signal-signal, and signal-light, and establishment for them of through tolerances and realization of their control makes it possible to advance the solution of the problem of organization of thorough control of the parameters of a complete path of CTB, and will make it possible to increase the quality of a color image on the screens of television receivers. Figures 2, tables 1, references: 11 Russian.
[238-6415]

UDC 621.397.232.6

FORM OF TELEVISION SIGNAL IN SYSTEMS WITH PARTIALLY SUPPRESSED SIDE BAND

Moscow ELEKTROSVYAZ' in Russian No 4, Apr 84 (manuscript received 9 Sep 82)
pp 56-58

SHABETNIK, V. D.

[Abstract] In determining the form of a signal at the output of television systems with a partially suppressed side band (radio transmitter and radio receiver), difficulties of a computational nature arise, because the problem of calculation of a cophased and quadratic component is not completely solved. The present brief communication proposes an algorithm for finding the form of such television signals on the basis of a fast Fourier transform (FFT). Calculation of the form of the television signal with the aid of a FFT algorithm is based on a discrete Fourier transform (DFT). The graph of a signal illustrating the calculation of a DFT with the help of a FFT algorithm is also presented. Figures 4, references 10: 8 Russian, 2 Western.
[238-6415]

MODIFICATION OF FREQUENCY SAMPLING METHOD ON BASIS OF STRUCTURE WITH QUADRATURE MODULATION

Moscow RADIOTEKHNIKA in Russian No 2, Feb 84 (manuscript received 25 Jun 83)
pp 19-23

VITYAZEY, V. V. and MURAV'YEV, S. I.

[Abstract] A modification of the classical frequency sampling method is proposed for the design of finite-memory digital band filters, particularly effective for narrow-band filters with different transfer functions covering a given frequency range. A structure with quadrature modulation is used and elementary filters of samples as a whole rather than individual resonators are synthesized on this basis. The filter circuit reduces to a plain digital storing circuit whose order is determined by the order of the ultimate filter. With the response $y(n)$ of the k -th filter of N -th order to an input action $x(n)$ described $y(n) = \sum_{l=0}^{N-1} x(n-l) \cos k\omega_0 l$ ($\omega_0 = 2\pi/N$ - referred frequency

of sample), the subsequent algorithm of filter synthesis involves 4 multiplications and $2N+1$ additions for each reading of the output signal, but the number of additions can be reduced by various means. One way is to insert two additional memory registers so as to reduce the number of additions to 7 while increasing the number of multiplications to 6 only. A better way is to use a multichannel digital storing device with scaling of intermediate variables so as to reduce the number of additions to $2\log_2(N+1)$ with again only 4 multiplications, which requires not more than $2N$ memory registers. In this case the noise in the filter output is determined by the rounding error in the scalars. A further modification reducing the number of comb filters is possible here. Figures 4, references 4: 3 Russian, 1 Western (in Russian translation).

[165-2415]

EFFECT OF ERROR BUNCHING ON INTERFERENCE IMMUNITY OF DIGITAL TRANSMISSION SYSTEMS

Moscow RADIOTEKHNIKA in Russian No 2, Feb 84 (manuscript received, after completion, 21 Jun 83) pp 58-61

OGANYAN, L. N., YEROKHIN, I. N. and LADOMIRSKI, Ya. A.

[Abstract] Digital transmission of service data is described mathematically without the use of Markov chains and with only the minimum number of experimentally determinable quantities, these four quantities including three error bunching parameters in addition to the number of clock intervals separating adjacent s-symbol service code groups, so as to account for distortion of service code groups caused by bunching of digital errors. The probability $P(i,n)$ of a packet of i errors appearing in an n -symbol cycle is calculated in terms of the bunching parameter α which characterizes the increment of probability $P(\geq, n)$ of distorting one or more symbols by increasing the number of symbols n , assuming an independent binomial distribution of errors within a packet and using the close approximation $P(\geq, n) = n \alpha^{-1} p$ (p - means probability of distorting a single symbol). Both analytical calculations and experimental data indicate that the trend of the error density $\sigma(i,n)$ curve is determined by the range of i/n ratios. Conventional means of error correction are considered on this basis, another method of particularly expedient in channels with high probability of interference in adjacent cycle positions being distributed transmission of service symbols. References: 7 Russian. [165-2415]

UDC 621.377.2

FEASIBILITY OF PARALLEL AND RECURSIVE ARRAY OF DIGITAL FILTERS

Moscow RADIOTEKHNIKA in Russian No 3, Mar 84 (manuscript received, after completion, 12 May 83) pp 87-91

YAROSLAVSKIY, L. P.

[Abstract] A parallel and recursive array of digital filters is considered for one-dimensional or multidimensional linear filtration, an array which contributes to both faster problem solution and greater universality. It is based on expanding the pulse response characteristic of a digital filter into an approximating array of linearly independent basis functions and then calculating the coefficients of this expansion recursively as the filter aperture scans the input sequence. The performance of the simplest and fastest one-dimensional recursive filter, namely a first-order one where each readout of the output signal depends on only one readout from the preceding step, is

evaluated in order to demonstrate the principle and its advantages. Basic functions satisfying this recursiveness criterion are found, with the aid of a fast Fourier transformation, to be discrete exponential functions and rectangular functions. In the case of two-dimensional filters, in addition to these "pure" basis functions, hybrid functions exponential along one coordinate and rectangular along the other coordinate also satisfy the requirements. Estimates indicate that the productivity payoff of paralleling with recursiveness is $g = N/R$ (N - number of pulse response quantization levels, R - degree of parallelization). The error of pulse response approximation, estimable according to the Parseval theorem when $R < N$, can be minimized by optimization of quantization range and step. Figures 3, references 2:

1 Russian, 1 Western.
[181-2415]

UDC 621.372.54

DIGITAL FILTERS WITH RETUNABLE PARAMETERS

Moscow RADIOTEKHNIKA in Russian No 3, Mar 84 (manuscript received 28 Sep 83)
pp 92-93

GREBENKO, Yu. A. and SEMKIN, A. A.

[Abstract] Digital filters with retunable parameters can be designed by the method of digital simulation of analog filters consisting of identical basic sections with returnable parameters. This reduces controlling the parameters of high-order filters to controlling the corresponding parameters of basic filter sections. The principle is, for illustration, applied to the design of digital models of first-order and second-order bandpass sections with retunable parameters. Predistortion is introduced for compensating the nonlinear changes in the frequency scale during bilinear conversion, especially when the discretization period is long and the law of parameter retuning must be changed. The discretization frequency can be selected so that the law of parameter retuning will be identical in the digital section and in its analog prototype. Figures 2, references: 2 Russian.
[181-2415]

UDC 621.372.54.037.372

DIGITAL MATCHED FILTER FOR PROCESSING PHASE-KEYED DISCRETE-COMPOUND-FREQUENCY SIGNAL

Moscow RADIOTEKHNIKA in Russian No 3, Mar 84 (manuscript received, after abridgment, 18 Nov 83) pp 94-96

BELYAYEV, V. S.

[Abstract] Processing a compound signal consisting of n phase-keyed frequency components is considered and a digital matched filter for this purpose is synthesized, with the assumption that all discrete frequency components have

the same amplitude and waveform. A filter with a matching complex frequency characteristic must have an adequate number of frequency channels with different time delays. In a filter synthesized for combining two operations, convolution of the phase-keyed part of the signal in the parallel frequency channels is followed by compression of the discrete-compound-frequency part of the signal. The entire optimal filtration can be designed to occur in the receiver. Each of the parallel frequency channels has a multiplier where the signal combines with a reference oscillation of a frequency equal to the carrier frequency of the given signal segment. Each multiplier generates a pseudorandom signal which corresponds to the given phase-keying law. This signal is discretized in time and its amplitude is quantized into two levels ("1" and "0") by a gate circuit. The digitized signal in each channel proceeds through a shift register, an adder, and an electronic delay line to a totalizer which adds signals from all channels. The output signal of this totalizer is checked for reception or rejection. Such a filter can be modified for noncoherent reception and for detection. Figures 1, references: 1 Russian. [181-2415]

COMMUNICATIONS

ALL EFFORTS ON IMPLEMENTATION OF FIVE-YEAR-PLAN TASKS

Moscow VESTNIK SVYAZI in Russian No 11, Nov 83 pp 2-3

BAYTSUR, G. G., RSFSR Minister of Communication

[Abstract] In the four years since the RSFSR Ministry of Communication has been established, a great deal has been accomplished but also a great deal is still to be done. The telephone network has expanded substantially, with 120,000 new subscribers added during this period, but service is not efficient enough. Facilities of the postal service have been expanded over an additional 80,000 m² of floor area and 84.8% of all PRAVDA newspaper copies are now distributed on the day of issue (only 82.8% in 1979). In order to meet the goals of this five-year-plan period within the remaining nine months, it is necessary to improve labor productivity through team organization and by stimulating socialist competitiveness while intensifying capital investment in construction and installation of new equipment. Greater effort will be required, particularly of communication workers who install and repair radio and television equipment in outlying populated areas, or postal workers who will have to cut delays in delivery (still 15% of all newspaper copies are now delivered 2-3 days late), and of communication experts who must mobilize and manage all available resources for this purpose.
[168-2415]

FIFTY YEARS OF MOSCOW URBAN RADIO RELAY NETWORK

Moscow VESTNIK SVYAZI in Russian No 11, Nov 83 pp 18-20

BULGAK, V. B., chief of Main Planned Financial Management, USSR Ministry of Communication

[Abstract] The history of the Moscow urban radio relay networks is reviewed, from installation of the first loudspeaker on the balcony of the Moscow City Council building in 1921 to the introduction of cable broadcasting during the 1962-67 period and subsequent developments. Credit is given to individuals and collectives of workers who have made outstanding contributions throughout the fifty years and beyond, honored as late as in 1981, not least during the

Second World War. Present activities include introduction of modern technology, equipment, and methods in cable broadcasting, planning and reconstruction to meet demands within the framework of the current five-year plan, and cooperation with urban radio relay networks in other socialist countries (East Berlin, Prague, Sofia, Ulan Bator). Figures 3.
[168-2415]

CONSULTATIONS ON WIRE BROADCASTING

Moscow VESTNIK SVYAZI in Russian No 11, Nov 83 p 43

YEVDOKIMOV, S. A., senior engineer, GKRU [expansion unknown]

[Abstract] Two questions are answered about 3-program wire broadcasting transmitters. The new UPTPV-60x2 unit currently in production consists of two 60 W transmitters mounted in a common cabinet, operating at carrier frequencies of 78 kHz and 120 kHz, respectively, each with a 120 W output stage. They operate from a single-phase 220^{+10%} V a.c. line, drawing not more than 900 W

-20%

for a broadcast signal. New equipment planned for production after 1983 includes the SLTU bay with transformer-type line amplifiers, to replace the obsolete and discontinued TU-0.4 amplifier, and the "Kardioida" antenna with electronically controllable radiation pattern in the horizontal plane and with remote frequency tuning for professional reception of long-wave or medium-wave radio relay signals with at least 15 dB suppression of interference signals from other stations. The questions were submitted by V. I. Shestopalov (senior engineer, Zaporozhye Communication Production-Engineering Management) and Kulikov (engineer, Mordovo Communication Production-Engineering Management).

[168-2415]

CONSULTATIONS ON CORROSION PROTECTION OF METAL IN UNDERGROUND COMMUNICATION EQUIPMENT

Moscow VESTNIK SVYAZI in Russian No 11, Nov 83 pp 43-44

NIKOL'SKIY, K. K., candidate of technical sciences, chief of laboratory, Central Scientific Research Institute of Communication

[Abstract] Three questions are answered about the corrosive action of stray d.c. currents on metal parts of underground communication equipment. The nature and the mechanism of such a corrosion are explained, its magnitude is evaluated in accordance with Faraday's law, and its contribution to overall ground corrosion is indicated. The corrosion hazard is estimated on the basis of theoretical calculations and experimental data pertaining to relevant electrochemical processes as well as electric potential and electrical resistance measurements. Protective countermeasures are twofold: limiting

the stray current in the ground at its source and limiting the stray current at its target while providing an easy return path. These countermeasures are implemented by appropriate layout of the communication equipment, by selection of suitable cables with adequate sheathing, and by installation of an electrically polarized current drain system. As protective devices are recommended commercially available PGD and PED gutters, as well as KSK-500 and KSK-1200 cathode grids which can be automatically controlled for regulation of the protective electric potential. Protective equipment must be periodically inspected. The questions were submitted by L. F. Lel'chuk (Alma-Ata), G. I. Tyryshkin (Novosibirsk), and A. Ye. Muller (Kiev).
References: 4 Russian.
[168-2415]

UDC 621.322.65

METHOD OF CONSTRUCTION OF INJECTION SYNCHRONIZED TRIGGER DEVICES

Moscow MIKROELEKTRONIKA in Russian Vol 12, No 6, Nov-Dec 83
(manuscript received 14 Dec 82) pp 568-572

SAMOYLOV, L. K., and ROGOZOV, Yu. I., Taganrog Radio Engineering Institute

[Abstract] The possibility is considered of a method of constructing economical trigger devices by means of the use of contemporary technological achievements in the field of injection circuitry engineering: use of reinjections, analog summators, and identity of parameters, as well as the possibility of using time storage of information in parasitic chains of circuits. The economy is shown of trigger devices constructed according to the proposed method. Figures 5, tables 1, references: 5 Russian.
[177-6415]

HOW TO IMPROVE PERFORMANCE OF TU-TS RELAY-STATION REPEATER EQUIPMENT FOR MEDIUM-SIZE AND SMALL TOWNS

Moscow VESTNIK SVYAZI in Russian No 12, Dec 83 pp 23-25

YUBEL', V. A., chief of station workshop, Riga radio relay center

[Abstract] Relay-station repeater equipment for large cities has been developed at the Central Engineering Office of the USSR Ministry of Communication. Such equipment for medium-size and small towns is now also commercially produced and, since 1975, gradually installed in the Riga radio relay center. It consists essentially of a PTsU central control panel, an AKU rack, an UKTP-3 rack, TU-0.05 amplifiers in the regional central broadcasting station, AUS-I and SVK-3 equipment in one base-level repeater station, STP-3 equipment in one transformer substation, and SKTP equipment supplementing STP-2 and STR-4 equipment in another transformer substation. This equipment

requires 24 and +60 V d.c. power supply in addition to the 50 Hz a.c. power line. The amplifiers require tuning, which is done with active filters having passbands sufficiently narrow for adequate immunity to intermediate-frequency interference and sufficiently wide for reliable response. False-alarm triggering of relays is avoided by means of limiting resistors which desensitize the filters to small step changes in the supply voltage. While the overall performance of TU-TS equipment has been found to be reliable, the controls in transformer substations are not yet complete and satisfactory. The layout of the central control panel must be modified so as to make all equipment mounted on it visible and accessible to the operator. The program reservation module on the AUS-I rack operates with RKM-1 relays which have stiff and poorly switching contactors. The amplifiers on the AUS-I rack and on the PTsU panel have too many stages, with direct coupling, subject to high-frequency and relaxation perturbations. Their design and layout should be improved so as to make tuning and repair less cumbersome. It would also be helpful to enlarge the PTsU central control panel for accommodating up to 20 base-level repeater stations and 40 transformer substations. With all these improvements made, the equipment should meet all current program broadcasting standards.

[167-2415]

AUTOMATED QUALITY ACCOUNTING OF CALL SERVICING IN 'NIKOLA TESLA' TELEGRAPH STATION

Moscow VESTNIK SVYAZI in Russian No 12, Dec 83 pp 27-28

ANDRYASHIN, Ye. N., senior engineer, and YEGOROV, A. I., candidate of physico-mathematical sciences, senior scientific research worker, Computer Center, Siberian Department, USSR Academy of Sciences; STUPAK, N. V., senior engineer, Irkutsk Telegraph Network

[Abstract] Automation of service quality accounting is being developed for the "Nikola Tesla" telegraph station with an "Elektronika-60" computer as a base. Indicators characterizing the performance of switching equipment are picked up by SM statistical counters, and equipment maintenance signals are picked up by KKS counters for processing in accordance with the standard inspection-and-correction procedure. Each SM counter is connected to a level converting and signal forming module. Accounting is done daily and weekly during peak load hours, as well as monthly for the payroll. The computer had been programmed for analysis and evaluation of data, and preparation of input data has also been automated. This accounting system already operates in the Tallinn telegraph network and will be introduced in the Irkutsk telegraph network. Further improvement of accounting, equipment maintenance and, consequently, service quality will involve the use of two microcomputers operating in real time for systematization and analysis of data from KANT and DKRT equipment with data storage on perforated tape. This automation of accounting should save 7250 rubles annually in labor costs.

[167-2415]

AUTOMATED MONITORING OF LENGTH OF TELEPHONE CONVERSATION

Moscow VESTNIK SVYAZI in Russian No 12, Dec 83 p 29

KHOKHLOVA, L. Ye., senior engineer, production-engineering laboratory, and
BERDNIKOVA, Z. A., engineer, Sverdlovsk Interurban Telephone Station

[Abstract] A new device has been installed in the Sverdlovsk interurban telephone station for time signaling during conversations over manual channels. This device, developed at the production-engineering laboratory of the Sverdlovsk Interurban Telephone System, can serve any number of cord pairs through a common PG2 pancake-type time switch, encoder, and minute-pulse shaper. Each code pair contains a memory cell and a KTRO start button, a coincidence circuit, and a transistor switch. Time switch and start buttons are mounted on the operator's table top, other components are mounted on a printed-circuit board underneath. Warning buzz, minute pulses, and 24 V supply are picked directly off the commutator. The telephone operator sets the time switch in the appropriate position and then connects the two parties. Having checked the beginning of the conversation, she pushes the start button. One minute before time is up the buzzer gives a warning signal of 5 s duration or longer, depending on the number of minute pulses. Before disconnection, the buzzer again gives a warning signal of 5 s duration. The device does not affect the performance of a cord pair and the telephone operator can also release the start button so as to allow for conversation without time limit. While the encoder is built on D9 diodes and the receiver-shaper of minute pulses is an OEP-13 optron with a series K155 LAZ microcircuit chip, other components are built with series K155 microcircuit chips. Switching devices use KT361G transistors with RES-9 relays in the collector circuits.

Figures 2.
[167-2415]

UDC 621.396.62:621.372.632

DISTORTION OF FREQUENCY-MODULATED SIGNALS IN DIGITAL FREQUENCY DIVIDERS

Moscow RADIOTEKHNIKA in Russian No 2, Feb 84 (manuscript received, after condensation, 7 Jun 83) pp 14-18

BOLMUSOV, Yu. D. and PAVLENKO, Yu. F.

[Abstract] The performance of trigger-type digital frequency dividers for processing FM signals is analyzed, of specific concern being their distortion of high-frequency FM signals. The sluggishness of such a device is characterized by two dimensionless parameters, namely turn-on delay time and turn-off delay time, both assumed to depend on neither the frequency nor the level of the input signal. The frequency divider receives signals from an amplifier and transmits pulses to a band-pass filter. Deviations from distortionless frequency division, namely from a uniform amplitude-frequency characteristic and from a linear phase characteristic are calculated for an ideal sinusoidally

modulated input signal converted to binary pulses with a 0.5 duty factor. Theoretical results indicate and experimental data confirm that only linear (frequency) distortion occurs during signal passage without accompanying amplitude modulation. With amplitude modulation and attendant amplitude-to-phase conversion, where the fundamental modulation-frequency harmonic is usually predominant but higher harmonics can also be significant, nonlinear distortion occurs there as well. The latter is most effectively reduced by means of limiters with low amplitude-to-phase conversion on the divider input side. Figures 7, references: 8 Russian.
[165-2415]

UDC 621.396.96

SCATTERING CHARACTERISTICS OF TARGET IN CASE OF MISMATCHED RECEPTION

Moscow RADIOTEKHNIKA in Russian No 2, Feb 84 (manuscript received, after condensation, 12 Jul 83) pp 24-26

BONDAREV, L. A.

[Abstract] The scattering parameter $\sigma(\Delta\omega)$ of a target is evaluated so as to make it possible analytically to relate this target characteristic to both the signal power at the output of a linear receiver channel and the frequency characteristic of the latter. This parameter replaces the effective scattering surface area of a target and eliminates the need for calculating the power of the reflected signal in two separate stages, first for a monochromatic probing signal and then at the output of a matched receiver. This relation, furthermore, also applies to receivers not matching the signal spectrum and to nonmonochromatic probing signals, and yields accurate calculations in each case. As a typical illustrative example a model target is considered consisting of two local reflectors, an incident signal with a rectangular spectrum of finite width, and a receiver channel wider than the signal spectrum. This scattering parameter and the effective scattering surface area become equivalent quantities in the case of matched reception. References: 1 Russian.
[165-2415]

IMPROVEMENT OF PERSONNEL SELECTION, PLACEMENT AND TRAINING

Moscow VESTNIK SVYAZI in Russian No 2, Feb 84 pp 3-5

BUTENKO, B. P., candidate of economic sciences, chief, Main Administration of Personnel and Training Institutions, USSR Ministry of Communications

[Abstract] Statistics are cited regarding the educational level of the 1.9 million workers employed in communications branches. Shortages of specialists with middle-level technical training are noted. It is recommended that

junior specialists be posted to those ministries where they can be put directly to work, thus forcing managers to place them properly. Shortages of qualified specialists to fill vacant management positions are noted. On-the-job training figures are cited, and work being done in order to improve political and professional knowledge is described.

[153-6900]

STEP-UP DEVELOPMENT OF SUBSIDIARY FARMS

Moscow VESTNIK SVYAZI in Russian No 2, Feb 84 pp 5-7

LEBEDEV, V. N., USSR Deputy Minister of Communications

[Abstract] The principles by which subsidiary farms are set up and supported under the USSR Food Program are described. The implementation of subsidiary farms within Union Republic Ministries of Communications is described. A "Long Range Plan for the Development of Subsidiary Farms by Enterprises and Organizations of the USSR Ministry of Communications System up to the year 1990" is described, which includes 347 subsidiary farms, 47 belonging to communications enterprises of national subordination and 300 to enterprises of the Union-Republic Ministries of Communications. The expansion of individual plots is described. Certain enterprises which are unable to set up their own subsidiary farms are participating in the organization of such farms with enterprises of other ministries and departments. Shortcomings in the organization of new farms and the extension of existing ones are discussed. It is noted that the land set aside for subsidiary farms for communications organizations is in many cases inferior and unsuitable for farming.

[153-6900]

SPEED UP CONSTRUCTION OF COMMUNICATION FACILITIES

Moscow VESTNIK SVYAZI in Russian No 2, Feb 84 pp 14

KHMELEVSKIY, A. V., chief, Svyaz'stroy-6 Trust

[Abstract] The integrated indicator of the construction prime cost of facilities is analyzed as a function of the duration of construction in order to determine the difference in profit from facilities constructed within the deadline specified by Construction Standards and Regulations and the profit obtained from facilities not completed according to these schedules. The construction of private-branch telephone systems for sovkhozes and kolkhozes in a number of areas is analyzed as an example. It is found that profit drops off sharply when construction schedules are not met. Tables 1.

[153-6900]

DEFICIENT TELEGRAPH SERVICE IN TYUMEN OBLAST

Moscow VESTNIK SVYAZI in Russian No 2, Feb 84 pp 15-16

LOBACHEVA, Ye. V., special correspondent

[Abstract] Findings of a September 1983 study of the operation of all communications subbranches in Tyumen oblast by the RSFSR Ministry of Communications are discussed. It is found that the requirements for telegraph service are not being met. Improper organization of work, unsatisfactory equipment conditions and high personnel turnover are found to be at fault. Recommendations are given for improving service.

[153-6900]

IMPLEMENTATION OF TEST-AND-CORRECT EXCHANGE OPERATING METHOD AT RAYON CENTERS

Moscow VESTNIK SVYAZI in Russian No 2, Feb 84 pp 24-26

ANDROS, T. I., candidate of technical sciences, first deputy minister of communications, Moldavian SSR

[Abstract] The test-and-correct method of operating ATSK and ATSK-U municipal crossbar exchanges is described, in which equipment operation is continuously monitored, and technical personnel intervene only if communications performance drops below an acceptable level. The testing equipment employed with the K-100/2000 automatic exchange is described. A method for determining performance indicators from counter readings is described which makes it possible to assess the operation of markers and registers and to make a primary diagnosis of malfunctions. Future plans call for automating the processing data from the counters and test increments. Figures 1.

[153-6900]

USE OF ISKRA-226 COMPUTER IN COMMUNICATION ESTABLISHMENTS

Moscow VESTNIK SVYAZI in Russian No 2, Feb 84 pp 30-31

APPAK, M. A., candidate of technical sciences, department chief, Moscow Oblast Scientific-Research Institute for Communications (MONIIS), and SHEYDVASSER, M. A., candidate of physical-mathematical sciences, senior scientific research worker, MONIIS

[Abstract] The use of the Iskra-226 personal computer in communication establishments for information retrieval and engineering purposes is described. The hardware configurations, specifications and capabilities of the Iskra-226 are presented. A BASIC program for calculating expected levels of utilization of communication services is described, along with an information retrieval system which displays information concerning communications enterprises and their computers. The extensive use of the Iskra-226 will increase programmer productivity and problem solving timeliness significantly. Tables 1.

[153-6900]

MODERNIZATION OF STV-DS-60 RINGING DEVICE MODULES

Moscow VESTNIK SVYAZI in Russian No 2, Feb 84 pp 31-32

KRYACHEK, V. G., senior scientific research worker, Kiev Branch of the Central Scientific-Research Institute of Communications(KONIIS), and LIMONOVA, S. B., senior engineer

[Abstract] More than half of all voice grade channel malfunctions are found to result from problems with the ringing device modules in the STV-DS-60 racks. An electronic ringing device and differential system has been developed by the Kiev Branch of the Scientific-Research Institute for Communications to replace malfunctioning electromagnetic relays. A functional diagram of the new device is presented, and its operation is described. Figures 1.

[153-6900]

AUTOMATION OF TRANSISTOR AMPLIFIERS

Moscow VESTNIK SVYAZI in Russian No 2, Feb 84 pp 34-35

VOL'SKIY, A. Ya., candidate of technical sciences, senior engineer, Central Wire Broadcast Station Moscow Municipal Broadcasting Rediffusion Network (MGRS), and VERBA, V. I., shop chief

[Abstract] Automation of transistor wire broadcast amplifiers is examined on the basis of the experience of MGRS. Multiple modular structure makes it possible to optimize amplifier characteristics by assembling the appropriate number of modules. Automatic handling of emergencies, switching over to reserve and optimization of equipment utilization are discussed. Figures 1, references: 3 Russian.

[153-6900]

POSSIBILITIES FOR REDUCING AMOUNT OF EQUIPMENT IN LONG DISTANCE NETWORK

Moscow VESTNIK SVYAZI in Russian No 2, Feb 84 pp 35-37

ANDREYEV, I. V., chief of LKS and STK service, TTsUMS-17, NARYSHKIN, N. I., chief, PTL, and SKOKOVSKIY, M. I., senior engineer, LKS and STK [expansion of all abbreviations unknown]

[Abstract] A method is described for arranging trunk lines between the terminal station of a radio relay link and the network node of a long-distance cable network which makes it possible to reduce the amount of expensive and scarce equipment needed, while meeting all performance requirements. The arrangement described makes it possible to eliminate a VLB-OP [expansion unknown] rack at the terminal station of the radio relay link. Diagrams of

the modified circuits employed are shown, and the frequency response of the correcting section is presented. Measurements made on a pair of trunk lines set up using this scheme indicate that the electrical characteristics of the lines meet all requirements. Tables 1, figures 7.
[153-6900]

AUTOMATED MONITORING OF INTRA-SYSTEM CALCULATIONS IN COMMUNICATIONS BRANCH

Moscow VESTNIK SVYAZI in Russian No 2, Feb 84 pp 38-39

KHOLODAR', V. I., VORONKOV, V. A. and POPOVA, O. V., Moscow Electro-technical Institute of Communications

[Abstract] The operation of a subsystem entitled "Financial Activity Management" of the Automated Branch Management System for Communications (ASUF-Svyaz') is described. The first phase of this subsystem incorporates a set of tasks involved in analyzing the financial activity of communications enterprises, production-technical communications administrations and ministries of communications; the development of the second phase of the subsystem is discussed. The minimum level of the second phase is to facilitate the acquisition of source information from the facilities being managed, obtaining payment data from the financial service of the managed entity, computational and logical processing of data by computer, and outputting information to the financial service of the management apparatus. Implementation of the second phase will improve the timeliness and efficiency of the work of the financial services of superior management entities.
[153-6900]

TELEPHONE COMMUNICATIONS CONSULTATION

Moscow VESTNIK SVYAZI in Russian No 2, Feb 84 pp 47-48

MELAMUD, E. A., candidate of technical sciences, Laboratory Chief, Leningrad Branch of the Scientific-Research Institute of Communications (LONIIS), and KOZLOVA, G. P., senior engineer

[Abstract] Answers are provided to technical questions submitted by operating personnel at ATSK-50/200 and ATSK-200 M telephone exchanges. These questions include: 1) failure of relay K4 to engage in RSLO set when outgoing set is seized; 2) excessively short ringoff pulse produced in direction of seized subscriber when making incoming connections; 3) excessive delay in releasing 5-digit register of ATSK-50/200-M exchange; 4) unreliable latching of VO relay; 5) improper latching of relays PTV2 and OT; 6) failure to generate disconnect signal; and 7) failure of system to register long distance seizure signal. Figures 4.
[153-6900]

EFFICIENCY OF CODING IN IDEAL DOUBLE-PHASE-KEYING CHANNEL WITH MEMORY

Moscow RADIOTEKHNIKA in Russian No 3, Mar 84 (manuscript received 11 Aug 83)
pp 34-39

KHATSKELEVICH, Ya. D. and BEREZKIN, V. V.

[Abstract] The efficiency of reflected coding (svertochnoe kodirovaniye) in a transmission system with an ideal double-phase-keying channel between encoders and decoders is evaluated on the basis of the signal phase and amplitude distribution during interrogation, this distribution being determined by intersymbol interference. The transient process is resolved into its inphase and quadrature components, in a polar system of coordinates. Calculations for a video signal with phase jump at the input of a square radio filter indicate that resolving two cyclically coded independent information fluxes in time is more efficient, in terms of lower error probability, than resolving them in place. There is no difference in the case of uncoded incoming information fluxes which use symbols independently. Figures 3, references: 2 Russian.
[181-2415]

REFLECTED CODING OF INFORMATION IN HIGH-SPEED DIGITAL COMMUNICATION SYSTEMS

Moscow RADIOTEKHNIKA in Russian No 3, Mar 84 (manuscript received 21 Sep 83)
pp 39-45

IVANOV, M. A., MAKARENKO, B. I. and YAKOVLEV, I. A.

[Abstract] Algebraical and statistical decoding of a reflected code (svertochnoe kodirovaniye) is evaluated comparatively from the standpoint of application to high-speed digital communication systems with memory, where errors bunch into bursts but single errors can also occur. While the performance of algebraical decoding is the same whether it is on a threshold basis or a majority basis, the performance of statistical decoding is different when based on the maximum-likelihood criterion (Viterbi algorithm) and when done sequentially. Algebraical decoding by either method and the two methods of statistical decoding are compared with respect to 15 performance indicators: feasible transmission rate, feasible code speed, ability to correct single errors, ability to correct error bursts, effect of error "multiplication", energy pay-off caused by coding, cost, complexity, required capacity of buffer memory, number of operations per informative symbol, required decoder speed, required precision of phase locking, required quality of operating channel, "robustness" with respect to changes in channel characteristics, and size of class of processable reflected codes. On the basis of this comparison, the optimum codes for that application are established in terms of maximum speed with minimum penalty in other characteristics. Tables 3, references 10: 4 Russian, 6 Western (4 in Russian translation).
[181-2415]

INCREASING DATA TRANSMISSION RATE BY RELATIVE METHODS

Moscow RADIOTEKHNIKA in Russian No 3, Mar 84 (manuscript received, after completion, 31 Oct 83) pp 45-48

SUKHORUKOV, A. S.

[Abstract] Relative methods of data transmission, with changes in signal parameters carrying the information, are evaluated in order to find ways to increase the transmission rate. As an example of these methods relative-phase keying is considered, a method widely used especially in communication channels with slow phase fluctuations. The transmission rate in such a channel, which deterministically and irreversibly converts message samples, is calculated for a group code appearing together with an additive normal noise, assuming constant channel parameters. The interference immunity of a single readout is also calculated for this case. The results reveal that the rate of data transmission within a limited frequency band, at a signal-to-noise ratio above the threshold, can be increased in this case by increasing the rate of correlated intersymbol interference. Figures 2, tables 1, references 4: 3 Russian, 1 Western (in Russian translation).

[181-2415]

OPTIMIZATION OF TELEGRAPH NETWORK--LABOR EXPENDITURE DECREASE WITHOUT ADDITIONAL CAPITAL INVESTMENT

Moscow ELEKTROSVYAZ' in Russian No 4, Apr 84 (manuscript received 15 Dec 83) pp 5-8

MARTSENITSEN, S. I., KOROL', V. I., BERSHTEYN, P. V., TARNOPOL'SKIY, I. L., ORESHKINA, K. N., KOLCHENKO, G. F., and PARIKOZHKA, I. A.

[Abstract] Under conditions of an acute deficit of labor resources, the problem of increasing the effectiveness of operation of the network becomes more and more pressing. In the 11th Five-Year Plan, introduction of switching communication centers began on the telegraph network. Thanks to these centers, on 1 January 1983 the daily average through traffic was decreased by approximately 30%. (For processing of such traffic, approximately 1500 telegraphists in through network units would be required.) As was shown by an investigation conducted by the Kiev Branch of the Central Scientific-Research Institute of Communications (TsNIIS), with participation of the Odessa Electrical Engineering Institute of Communications imeni A. S. Popov, a farther valueable reduction of through traffic can be obtained as the result of an introduction into the network of an optimum circuit for direction of the flow of telegrams. Such an undertaking first began to be put into practice in the first half year of 1983, which already by the end of the year made it possible to reduce labor

costs with respect to processing through telegrams by a further 31.2% as compared with January 1983. (This is equivalent to a reduction of approximately 1050 telegraphists in through network units.) Input data for optimization and limitation, an optimization algorithm, and the order of introduction of the results of optimization are discussed. References: 3 Russian.
[238-6415]

UDC 621.395-645.15

ORGANIZATION OF REPAIR OF APPARATUS AND EQUIPMENT OF PRIMARY TRUNK COMMUNICATION NETWORK

Moscow ELEKTROSVYAZ' in Russian No 4, Apr 84 (manuscript received 3 Aug 82)
pp 8-10

GNIDENKO, I. I. and SAZONOV, Ye. N.

[Abstract] During automatization of the processes of technical exploitation of a primary trunk communication network, one of the important problems is to assure a high availability factor of apparatus and equipment, i.e., improvement of the processes of technical servicing and repair of apparatus and equipment. In the primary trunk communication network, such a problem is placed on a repair subsystem, functioning in the composition of an automated system of operative-technical servicing (ASO-TO). It is necessary that the repair subsystem solve the following problems: 1) Repair of apparatus and instrumentation; 2) Material-Technical provision for this repair; 3) Consideration of availability and expenditure of spare parts, materials, and accessories; 4) Composition of graphs of repair and monitoring of their fulfillment; and 5) Preparation of statistical accounts. The paper lists subsystems with which the repair subsystem has functional communication through the information subsystem. It was necessary to create the "TTsUM" (expansion unknown) repair service in the structure of the repair subsystem in order to assure contemporary technology, technical means, a measuring devices plant, and repair documentation, and in which processes of record keeping and planning of repair are automated with the use of an electronic computer. The paper presents a list of technical means and repair documentation developed in order to realize the proposed repair subsystem in KONIIS (Kiev Branch of the Central Scientific Research Institute of Telecommunications). Figures 1, references: 2 Russian.
[238-6415]

PROSPECTS FOR INCREASE OF EFFICIENCY OF RURAL PRIMARY NETWORKS

Moscow ELEKTROSVYAZ' in Russian No 4, Apr 84 (manuscript received, after revision, 10 Nov 82) pp 10-12

BAYEV, A. P. and NIKIFOROV, N. P.

[Abstract] Digital transmission systems with pulse-code modulation are widely used for the development of rural primary networks (RPN). Massive introduction into RPM of cable and radio relay transmission systems, and the resultant test of their operation as well as entry into production and exploitation makes it possible to proceed to the creation of a second generation of pulse-code modulation equipment for RPN. Basically, the equipment conforms to the recommendations of the MKKTT (International Telegraph and Telephone Consultive Committee) and is compatible with their work on networks. A version of the circuit for construction of a network is proposed which with its optimum configuration will respond to contemporary requirements with respect to the quality of communications, reliability, stability, reduction of capital expenditures on the creation and growth of the network, and decrease of the expenditures for cable and equipment. Construction of a digital RPN and the possibility of increasing the efficiency of a RPN are discussed. Practical realization of the prospects shown for an increase of the efficiency of RPN requires the solution of a number of organization-technical problems, which are outlined. Figures 4, references: 4 Russian.
[238-6415]

UDC 621.395.341

SYSTEM OF ORGANIZATION OF REVERTIVE RINGING AT CENTRAL, JUNCTION (TERMINAL) STATIONS OF RURAL TELEPHONE NETWORK

Moscow ELEKTROSVYAZ' in Russian No 4, Apr 84 (manuscript received, after revision, 30 Dec 81) pp 13-15

BOZHENKO, G. I. and YELEKOYEVA, E. K.

[Abstract] Problems of centralizing operation of the objects of a rural telephone network (RTN), and the principles of development of the apparatus for automatic centralized field inspection of a RTN have already been considered in ELEKTROSVYAZ', No 9, 1982. The present paper is concerned with one of the principal indices of the operation of dialing equipment--the coefficient of nonpassage of calls which determines the quality of service for subscribers. This index is established by conducting revertive ringing. In order to increase the productivity of work and to improve control during operation and functioning of the equipment of automatic telephone stations (ATS) in the case of organization of centralized operation on RTN, it is necessary to conduct automatic revertive ringing within the limits of the

service area, both for each ATS and with respect to the individual sections of interexchange communication. The paper is one of a series intended for familiarization of specialists with problems of creating centralized operation of RTN. Figures 1.
[238-6415]

UDC 621.373.826:621.396

CHOICE OF LINEAR CODES FOR DIGITAL FIBER-OPTICAL COMMUNICATION LINES

Moscow ELEKTROSVYAZ' in Russian No 4, Apr 84 (manuscript received, after revision, 10 Sep 81) pp 22-25

BUKHINNIK, A. Yu. and KUSHNIR, V. F.

[Abstract] The paper notes that three Western and one Russian work are devoted to a choice of linear codes for transmission of information by means of digital fiber-optical communication lines (TsVOLS), where a comparison of the codes is made by various criteria, among which two play an important role, connected between themselves: the permissible length of the reclamation sections and the energy expenditures of the optical transmitters. As a rule, in so doing, the parameters of the linear channel and the linear signal are considered as assigned and invariable. However, development of the potential possibilities of codes requires the solution of more complex problems, the conditions of which allow matching of the parameters of the channel and signal, individually, with each of the codes being compared. In the present paper, a method of such matched comparison is developed with respect to prospective two-level codes [described in IEEE Trans. on Commun., 1976, COM-24, No 4] with construction of TsVOLS on the basis of multimode fibers with a stepped or gradient profile of the index of refraction. Figures 1, references 9: 2 Russian, 7 Western.
[238-6415]

UDC 621.376.56.001.4:621.391.1.037.372

FORMING OF TEST SIGNALS AND REVEALING ERRORS IN MULTILEVEL LINEAR CHANNELS OF DIGITAL TRANSMISSION SYSTEMS

Moscow ELEKTROSVYAZ' in Russian No 4, Apr 84 (manuscript received 14 Jun 83) pp 31-35

GUREVICH, V. E. and NEGRIYENKO, A. Ya.

[Abstract] This paper is concerned with methods which make it possible substantially to simplify realization of complete instrument sets for linear channels of high-speed digital transmitting systems and to accelerate their creation by conducting development of a channel simultaneously with development of a coder and decoder. A method is proposed for "programmed" forming

of a multilevel test sequence, not requiring multilevel balancing codes, and an asynchronous method for revealing errors, making it possible to discard the decoder of a multilevel signal, a standard signal generator, and a device for cyclic synchronization. Figures 6, tables 1, references 9: 7 Russian, 2 Western.
[238-6415]

UDC 621.395.52

METHOD OF DETERMINING NUMBER OF STORAGE CELLS IN COMPOUND DIGITAL CHANNEL*

Moscow ELEKTROSVYAZ' in Russian No 4, Apr 84 (manuscript received 2 Jun 82)
pp 35-39

OGANYAN, L. N.

[Abstract] In spite of the presence of a large number of publications devoted to the problem of synchronization in digital communication networks, a method is still lacking for determining the number of storage cells in a compound digital channel, with allowance made for fulfillment of the requirements. A study is made in the present paper of a system of synchronization based on the parameters of a digital channel, and an example is given of a calculation of the number of storage cells in a digital channel. The results obtained in the paper make it possible to determine the principal partial parameters of a compound digital channel as a function of its structure, the properties of the line and the system of cadence synchronization. Figures 2, references 12: 9 Russian, 3 Western.

[* By analogy with the term "sostavnoy kanel" (compound channel) [[GOST 22348-77 "Single Automated Communication Network]], here under the term "digital compound channel" is understood a digital channel with transits and signal switching only in digital form.]
[238-6415]

UDC 621.395.341.71

USE OF MICROPROCESSORS FOR ADDRESS INFORMATION RECEPTION

Moscow ELEKTROSVYAZ' in Russian No 4, Apr 84 (manuscript received, after revision, 22 Jun 83) pp 43-45

STEPANOVA, I. V.

[Abstract] In connection with automatic switching and synthetic telephony, this paper considers the use in existing and proposed telephone stations and units of microprocessors (MP) for the simultaneous, high-speed reception, processing, and storage of address information incoming from subscribers in

the form of dialing pulses. The basic stages in dialing and the branches of the algorithm corresponding to them are distinguished. In addition, the question of a rational transition from the analog signals of dialing pulses to the digital form of presentation is investigated, and the quality indices of the MP, as well as the possible number of maintenance objects are considered. Figures 2, references: 4 Russian.
[238-6415]

UDC 621.316.5

BRIDGE EROSION IN ELECTRICAL CONTACTS

Novocherkassk IZVESTIYA VYSSHIKH UCHEBNIKH ZAVEDENIY: ELEKTROMEKHANIKA in Russian No 2, Feb 84 (manuscript received 16 Nov 82, after completion 31 Jan 83) pp 71-77

SHABANOVA, ZOYA VLADIMIROVNA, senior teacher, and NEKRASOV, SERGEY ALEKSANDROVICH, student, Novocherkassk Polytechnic Institute

[Abstract] The physical process of bridge erosion in low-current electrical contacts is described by a model of mass transfer during switching, without assuming steadiness of the process and one-dimensionality of the corresponding Stefan problem. Changing of the current density, redistribution of Joule-effect sources with attendant shifting of the hot spot, and the skin effect following an increase of electrical resistance are taken into account, all these effects resulting from changes in bridge cross sections, as well as second-order thermoelectric effects. Two problems are formulated and successively solved on the basis of this model. The first problem is determining the evolution of the bridge shape from the originally cylindrical one. The equation of motion for the melting front is used for this purpose with the melting coefficients most closely approximating the solution to the exact Stefan problem. It is solved for a set of six constraints: two conditions of transversality, two conditions of intersection, one condition of isocubicity, and one of the boundary conditions in the corresponding variational problem. The solution reveals that the narrowest cross section of the bridge shifts in time toward the anode. It also yields the likely time and location at which a break will occur. The second problem is determining the temperature field of a variable-section bridge, taking into account the temperature dependence of electrical resistivity but disregarding the less significant temperature dependence of thermal conductivity and specific heat. The corresponding equation of heat conduction is solved for appropriate moving boundary conditions and conditions of thermal coupling. The volume of material transferred across a contact bridge of small dimensions is then calculated, with a correction for noncylindricity of the bridge. Figures 1, references 6: 5 Russian, 1 Western. [189-2415]

ROLE OF ELECTROTHERMAL PROCESSES IN ECONOMY OF ENERGY RESOURCES FOR
MANUFACTURE OF END PRODUCT

Moscow ELEKTROTEKHNIKA in Russian No 2, Feb 84 (manuscript received 1 Jun 83)
pp 2-5

AL'TGAUZEN, A. P., candidate of technical sciences, BORODACHEV, A. S.,
candidate of technical sciences, and MESHCHERYAKOV, A. I., engineer,
All-Union Scientific Research Institute of Electrothermal Equipment

[Abstract] The effect of electrical heating in production processes is discussed and evaluated from the standpoint of overall fuel economy. The advantages of fast and efficient local heating in metallurgical processes and in heat treatment of metal products are illustrated with specific examples. The advantages of new electrothermal methods and equipment, specifically ion-beam and laser-beam heaters, are reviewed also taking into consideration product quality improvement and metal economy in given manufacturing cycles. Further increase of energy saving will require larger electrothermal equipment, intensification (acceleration) of the heating process, improvement of control and automation, mechanization of loading--transportation--unloading operations, systematic heating without wasteful intermittent cooling, improvement of equipment performance characteristics, use of better electrical insulation, change to solid-state (thyristorized) electric power supplies for furnaces, use of low-inertia furnace lining, better control of gas dynamics in furnaces, thermal sealing and shielding of furnaces against heat leakage. Under consideration is combined heating, with electric current and with flame burner, for optimization of metal smelting and heat treatment. For better utilization of secondary energy sources are considered more extensive reprocessing of scrap metal, which requires less energy than processing of raw metal; more complete extraction of heat and chemical energy from flue gases, which have a content of carbon dioxide and water vapor, as well as from entrapped dust containing carbon compounds; extraction of heat from circulated cooling water; transfer of heat from hot finished parts to cold blank parts; use of heat pumps handling dumped energy. Other economy measures include rescheduling of operations from day shift to night shift so as to reduce the peak load on primary power plants while increasing the utilization factor, especially with addition of energy-storing devices to electric furnaces. References:

4 Russian.

[166-2415]

EFFECTIVENESS OF NEW TECHNICAL SOLUTIONS TO PROBLEM OF SUPERHIGH-POWER
ELECTRIC-ARC STEEL MELTING FURNACES

Moscow ELEKTROTEKHNIKA in Russian No 2, Feb 84 (manuscript received 1 Jun 83)
pp 9-11

PEL'TS, B. B., candidate of technical sciences, DAVYDOV, V. P., engineer,
PIROGOV, N. A., candidate of technical sciences, and PONOMAREV, Ye. M.,
engineer, All-Union Scientific Research Institute of Electrothermal Equipment

[Abstract] Superhigh-power electric-arc steel melting furnaces have been developed since the nineteen seventies, in order to meet the demand for steel by the end of this century. The first superhigh-power high-capacity Soviet-made model is the DSP-100N3A with a 50(63) MVA transformer, 10 units having been built and installed during the 1977-82 period. Its design is based on the two-slag process common to all electric-arc steel melting. On the basis of experimental and pilot operation, the transformer has been redesigned so as to deliver a secondary voltage of 573 V and 63 MVA to the load instead of the original 46 MVA at 514 V. Matching of the transformer with the melting process in Donets and Uzbek steel making plants, by decreasing the asymmetry of secondary reactances, has made it possible to utilize fully the 39 MW active power without weakening the furnace lining. The next model is the DSP-100I6 furnace with a 16000/35 transformer of 75 MVA capacity, which can be raised to 90 MVA by means of constant-power staging. Another major feature of this furnace are water-cooled rather than refractive wall lining and roof, which are better able to withstand the high operating power. It has been designed with maximum metal economy in the structure, with 21% less metal than the DSP-100N3A structure. Its operation is characterized by minimum idle time, one minute of idling being equivalent to additional expenditure of 150 kWh/ton (only 30-50 kWh/ton with refractory wall lining and roof) on reheating and remelting. In an aggregate configuration, this furnace can produce 350-440 thousand tons of steel annually. Steel is melted faster (in 1.15 h) here than in the DSP-100N3A furnace. Addition of oxyacetylene burners further shortens the melting time and saves up to 15% of electric energy. The water-cooled wall lining and roof not only facilitate operation at high power levels but also require fewer repairs and overhauls. Operation of the furnace is monitored, controlled, and optimized by means of program logic. Figures 1, references: 5 Russian.

[166-2415]

DEVELOPMENT AND PRODUCTION OF NEW SERIES OF INDUCTION FURNACES FOR MELTING FERROUS METALS

Moscow ELEKTROTEKHNIKA in Russian No 2, Feb 84 (manuscript received 1 Jun 83)
pp 19-21

PROSTYAKOV, A. A., doctor of technical sciences, and LADOZHSKIY, V. G.,
engineer, All-Union Scientific Research Institute of Electrothermal Equipment

[Abstract] Recent research and development have resulted in two new series of crucible-type induction furnaces for iron casting and steel making. They combine high technical and economic performance indicators with all-around mechanization and automation. Seven models of the IChT series, operating at commercial 50 Hz frequency, range in size (capacity) from 1.0 to 60.0 tons with corresponding power rating of 0.394-21.66 MW. Seven models of IST series, operating at intermediate frequencies of 500, 1000, 2400 Hz, range in size (capacity) from 0.06 to 6.0 tons with corresponding power rating of 90-2240 kW. Both series have been designed in accordance with the principles of magnetohydrodynamics, under given power and cost constraints. High-efficiency operation is achieved by minimization of electrical and thermal losses on the basis of computer-aided design of the inductor-metal system, by innovative layout of the melting process, and by full utilization of installed voltage-transformer and frequency-converter capacity. Equipment includes symmetric inductive-capacitive 3-phase power supplies, automatic regulation matched to process conditions and requirements, and differential monitoring with protective relaying. Electromagnetic components are built with cold-rolled electric-grade steel laminations, water cooling of conductors, and high-temperature insulation. Rubber and asbestos are used for preventing heat leakage. Proper ventilation and exhaust are provided for hygiene and health maintenance. Installation and operation of these furnaces should result in an annual iron casting output of approximately 700 thousand tons by the IChT units with a cost saving of over 18 million rubles, the cost saving of steel making with the IST unit being more than 40 million rubles annually. Figures 2, tables 2, references: 2 Russian.
[166-2415]

ELECTRIC RESISTANCE FURNACES FOR POWDER METALLURGY AND SINTERING IN CONTROLLABLE ATMOSPHERES

Moscow ELEKTROTEKHNIKA in Russian No 2, Feb 84 pp 40-42

ARTEM'YEV, V. D., candidate of technical sciences, KATEL', N. M., engineer,
and RUBINCHIK, L. Ye., engineer, All-Union Scientific Research Institute of
Electrothermal Equipment

[Abstract] Electric furnaces have been developed for meeting the current and future requirements of powder metallurgy. There are already 120 different

models of such furnaces available for 17 basic technological processes. These include annealing, reduction, sintering, hardening of powders and powder products as well as generating controllable atmospheres. The seven models for processing iron powders in a hydrogen atmosphere include two SKN high-capacity (450 and 850 kg/h) units with conveyor-belt feed and with self-hermetization by processed powder rather than use of fire-proof sealing curtains, one SKZ low-capacity special-purpose unit for sintering and plasticizing with conveyor-belt feed, one SKZ medium-capacity unit for sintering iron and copper powders with conveyor-belt feed, two STN small units for sintering iron and iron-alloy powders with plunger feed ensuring better hermetization and high product quality, and one SYuN medium-capacity unit with staircase hearth for sintering iron-alloy and heat-resistant powders. Feed and temperature in all furnaces are controlled automatically. Figures 2, tables 1.
[166-2415]

UDC (621.365.4:621.365.9).001.3

ELECTRIC RESISTANCE FURNACES WITH ELECTRON-ION HEATING FOR SINTERING REFRACTORY METALS

Moscow ELEKTROTEKHNIKA in Russian No 2, Feb 84 (manuscript received 1 Jun 83)
pp 42-44

KOVALEV, M. N., candidate of technical sciences, KULIKOV, V. P., engineer, PETROV, L. N., candidate of technical sciences, and ZAYKIN, Ye. I., engineer

[Abstract] A vacuum-type electric resistance furnace for sintering molybdenum, tungsten, and refractory alloys has been developed which uses electron-emission heating to 2500 K and higher temperatures after radiative preheating. The blank and a thermal shield inside the furnace serve as the cathode, and a plate underneath insulated from the furnace housing and the resistance heater serves as the anode. After the temperature has been raised to approximately 2000-2300 K by radiative heating with a TPT-63/17PK 3-phase transformer and an RNTT-330-250 V regulator as power source, a voltage of 1000-3000 V is applied across the blank and plate from a TPT-63/1200PK 3-phase transformer through a full-wave rectifier built with avalanche diodes. An oriented electron beam impinging on the metal surface ensures fast and uniform heating. Decreasing the distance from blank to heater improves the performance by facilitating the use of a stronger electron beam at already lower temperature. The heating process can be supplemented with ion-beam treatment of the product. An industrial model of such a furnace for sintering products up to 300 mm high and 200 mm in diameter has been built with an installed capacity of 49 kW for radiative preheating (36 kW required) and 133 kW for electron-beam heating (120 kW required). The nominal temperature in the active furnace space is up to 1873 K during radiative heating and up to 2773 K during electron-beam heating. The furnace weighs 2 tons. Processing in it reduces metal waste through uniform heating of the entire volume and improves the product quality through better refining with much more effective removal of gaseous inclusions than in conventional contact heating-sintering. Figures 2, tables 4.
[166-2415]

COMPUTERS

UDC 681.518.52

CONSTRUCTION OF CHECKING TESTS FOR PROGRAMMED LOGIC MATRICES WITH MEMORY

Moscow MIKROELEKTRONIKA in Russian Vol 12, No 6, Nov-Dec 83
(manuscript received 10 May 82) pp 561-567

VOLYNSKIY, M. B. and NOVOSELOV, V. G.

[Abstract] A method is considered for construction of checking tests (PT), intended for monitoring programmed logical matrices with memory (PLMM). The method is oriented towards the construction of tests for PLMM of real dimensions ($n + p, q, M$ of the order of $20 + 100$). This method substantially differs from algorithms for construction of PT for series circuits. The PT is oriented towards the detection of individual programming inaccuracies of the PLMM: the absence of the necessary or the presence of superfluous coupling elements. A special algorithm is developed for synthesis of adjusting of sequences, taking into account the characteristics of modelling the inaccuracies of PLMM in Boolean space. Figures 6, 2 Western (1 in Russian translation), 4 Russian. [177-6415]

UDC 681.327

COMPUTERS AND MULTIPLE-VALUED REPRESENTATION OF INFORMATION

Moscow MIKROELEKTRONIKA in Russian Vol 13, No 2, Mar-Apr 84
(manuscript received 4 Aug 82) pp 99-106

RAKOV, M. A., Physicomechanical Institute, UkSSR Academy of Sciences

[Abstract] Problems concerned with the construction of microelectronic devices for computing technology are considered. A primary example of such a problem is that of external and interior couplings (connections), which clearly appears during creation of modern large-scale integrated circuits (BIS) and super-BIS. The possibility is found of solving many of these problems in an effective manner by the use of multivalued (nonbinary) information representation. The principles of construction, circuits and the properties of multivalued hybrid structures are described. One of the transitional steps during creation of multivalued structures may be a combination of multivalued and

binary presentation of information. Use of mixed (multiple-binary and multiple-analog) representation of information is an inevitable stage of growth of multivalued computing structures. Figures 6, references 10: 6 Russian, 4 Western.
[205-6415]

UDC 621.372.54

ARCHITECTURE OF ADAPTIVE SPACE-FREQUENCY-TIME SIGNAL PROCESSING SYSTEM

Moscow RADIOTEKHNIKA in Russian No 3, Mar 84 (manuscript received, after completion, 1 Nov 83) pp 15-20

STRUCHEV, V. F.

[Abstract] Digital processing of signals in real time requires high-capacity high-speed computer systems, which applies particularly to adaptive processing. The three basic factors determining the most suitable type of system are organization of calculations made by the processor array, range of problems to be handled, and interaction of memory modules, processors, and input-output channels. In terms of the first criterion it is possible to combine single instruction or multiple instruction with single data or multiple data into four correspondingly different systems: SISD, MISD, SIMD, MIMD. In terms of the second criterion there are general-purpose, limited scope, and special-purpose processors. In terms of the third criterion there are lumped and distributed structures. The choice is based on the particular algorithm of space-frequency-time processing, all algorithms being derivable from the simple expression $Y = TXo$ (Y- matrix of output data, X- matrix of input data, T- matrix of weight factors in the frequency-time domain for signal filtration, o - matrix of weight factors in the space domain for plotting radiation patterns). The architecture of the system as well as the structure and the capacity of its components will depend on the combination and the sequence of transformations involved in the signal processing. The eleven different transformations which can be involved in such processing are: Fourier transformation (FT), measurement or compensation of phase-frequency distortions (CD), analysis of the correlation matrix (AC), suppression of interference signals (SI), plotting radiation patterns (PP), multiplication by a reference signal (MR), weighting (W), inverse Fourier transformation (IF), accumulation of signals (AS), logic processing (LP), and synthesis of readings (SR). Among the simplest processing chains are FT-CD for measuring phase-frequency distortions and PP-FT-MR-IF-LP-SR for detection of interference-free signals. One of the most complex processing chains is FT-CD-SI-PP-MR-W-IF-AS-LP-SR. Tables 2, references 6: 5 Russian, 1 Western (in Russian translation).
[181-2415]

MICROPROCESSOR IMPLEMENTATION OF ALGORITHMS OF NONLINEAR FILTRATION

Moscow RADIOTEKHNIKA in Russian No 3, Mar 84 (manuscript received 6 Oct 83)
pp 20-24

KHARISOV, V. N., KIRILENKO, Yu. N., MAKLYUKOV, M. I. and FEDOROV, A. I.

[Abstract] The basic recurrence-type algorithm $\lambda_{i*} = \lambda_{i,ex} + RF_i'(\lambda_{i,ex})$ of nonlinear filtration of a useful signal with an n-dimensional vector of parameters λ in the Gaussian approximation (λ_{i*} - instantaneous estimate of parameters λ , $\lambda_{i,ex} = \lambda_{i-1}$ - extrapolated estimate of parameters λ , Φ - transition matrix, R - correlations matrix of estimate errors $F_i'(\lambda_{i,ex})$ - derivative of the logarithm of the likelihood function) needs to be transformed for high-speed implementation on microprocessors with sufficiently small time discretization steps and for thus facilitating signal reception in real time without significant degradation of the characteristics. In the case of slowly varying signal parameters λ this algorithm can be transformed by grouping of observations. In the case of a narrow-band output signal this algorithm can be transformed through quadrature representation of the input process and further through control of samples, namely control of their moments depending on the instantaneous estimates of the signal phase. These techniques are, for illustration, applied to optimal reception of phase-keyed signals with random phase and frequency according to the equations of filtration of discrete-continuous processes. The demodulator for this algorithm consists of an arithmetic logic unit with cache, a control unit, a data input unit with sample storage and analog-to-digital converter, a multiplier, a permanent microprogrammable memory, and a pipeline-type microinstruction register. A series 1804 microprocessor has been selected for this demodulator, its component built where appropriate with series 1804 and 589 microchips. Figures 2, references 6: 5 Russian, 1 Western (in Russian translation).
[181-2415]

UDC 621.391.17:681.3

REVISION OF SIGNAL AND INTERFERENCE SPACE-TIME PROCESSING ALGORITHMS FOR IMPLEMENTATION BY MICROPROCESSORS

Moscow RADIOTEKHNIKA in Russian No 3, Mar 84 (manuscript received 21 Jul 83)
pp 48-51

GLUSHANKOV, Ye. I.

[Abstract] Conventional adaptive algorithms of signal and interference space-time processing in radar and radio communication systems can be implemented by high-speed microprocessors, but only when the number of elements in the receiver

antenna array is small. When the number of elements is large, then use of high-speed microprocessors requires simplification of these algorithms and an increase of their immunity to errors in digital processing. From this standpoint, three such algorithms (Windrow-Hoff steepest descent, direct inversion of sampled covariational interference matrix, Kalman filtration for estimating the vector of weight factors) are evaluated comparatively with respect to the two usual criteria: number of arithmetical operations (additions and subtractions, multiplications, divisions) and required memory capacity. Implementation of these algorithms by a special-purpose microprocessor with series K584 large-scale integration and microprogram control is analyzed, accordingly, a special-purpose microprocessor being preferable to a general-purpose microcomputer or minicomputer on account of smaller size and mass, lower cost, and lower power consumption at some sacrifice of processing speed. The required excess word length in the microprocessor over the word length in the analog-to-digital converter is smallest for the Windrow-Hoff algorithm and largest for the Kalman filtration algorithm. A floating rather than fixed decimal point in the microprocessor is preferable for the Windrow-Hoff algorithm, the direct-inversion algorithm, and for the Kalman filtration algorithm when the number of elements in the receiver antenna array is equal to or larger than 46, 24, and 8 respectively. Partial disregarding of cumulants and matrix triangulation according to the Holecki [Kholetskiy?] theorem are effective methods of reducing the complexity of algorithms, while statistical regularization increases their immunity to errors. Figures 3, tables 1, references 10: 6 Russian, 4 Western (4 in Russian translation).
[181-2415]

UDC 621.396.96

EFFICIENCY OF COMPUTER SYSTEM DIGITAL PROCESSING OF SIGNALS

Moscow RADIOTEKHNIKA in Russian No 3, Mar 84 (manuscript received 11 Oct 83)
pp 52-55

STRUCHEV, V. F. and LEVSHIN, V. P.

[Abstract] A computer system for adaptive space-frequency-time processing of signals is considered which features maximum possible paralleling of identical modules so as to ensure high productivity. Each module contains one or several microprocessors operating with an appropriately distributed common memory, capable of performing such operations as complex addition and multiplication, with means available for data transposition from a cell of one module to a non-corresponding cell of another. The efficiency of this system is evaluated in terms of two parameters: s -user speed attainable in solving an individual problem and ratio s/s_n of s -user speed to nominal speed of all modules. The first problem is determining the number of parallel modules, which is equal to the number of space channels and in the case of adaptive processing must provide for recurrent intermodular data transposition. A procedure is established entailing a sequence of 10 system operations, each with a corresponding module operation and for which the processing time, the processed data volume, and

the corresponding memory load are then determined. In solving four transformation problems (Fourier transformation, compensation of frequency distortions in channels, plotting radiation patterns, convolution of discrete sequences by means of fast Fourier transformation) the user speed approaches the nominal speed. In solving one transformation problem, namely estimating the inverse correlational matrix, the user speed approaches 70% of the nominal speed. Tables 2, references 4: 2 Russian, 2 Western (both in Russian translation). [181-2415]

INVESTIGATION OF ELECTROSTATIC FIELDS OF INSULATORS OF GAS-FILLED EQUIPMENT

Minsk IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: ENERGETIKA in Russian No 4,
Apr 84 (manuscript received 30 Mar 83) pp 43-46

BOBIKOV, V. Ye. and TRIPOTEN', I. G., engineers, All-Union Electrotechnical
Institute imeni V. I. Lenin

[Abstract] The intensity of an electrical field at the surface of an insulator is determined to a considerable degree by the geometrical form. It is possible by an especial choice to obtain a surface profile so that the gradient of the field at the surface nowhere exceeds the maximum intensity of the external field. The calculations and experiments conducted indicate the advisability of a finning device in designs of gas-filled equipment. Figures 2, references: 3 Western.
[203-6415]

GLOW SPOTS AND BREAKDOWN IN GaAs TRANSISTOR STRUCTURE

Leningrad FIZIKA I TEKHNIKA POLUPROVODNIKOV in Russian Vol 17, No 11, Nov 83
(manuscript received 25 Mar 83, signed to press 16 Jun 83) pp 1931-1934

KERNER, B. S., KOZLOV, N. A., NECHAYEV, A. M. and SINKEVICH, V. F.

[Abstract] An experimental study of field-effect transistors with GaAs structure and a Schottky gate has established that the cause of irreversible changes preceding breakdown in such devices is the localized emission of radiation and the appearance of glow "spots" following the formation of multifilar and multidomianial states. The experiment was performed with standard structures: a buffer n⁻-layer and a $(0.15-0.3) \cdot 10^{-4}$ cm thick active n-GaAs layer on a seminsulated GaAs Cr substrate, with the concentration of equilibrium electrons $(1-2) \cdot 10^{17}$ cm⁻³ in the active layer and not exceeding 10^{14} cm⁻³ in the buffer layer, AuGe-Au film contacts on source and or drain, and an Al firm Schottky gate. These structures were $15 \cdot 10^{-4}$ or $15 \cdot 10^{-3}$ cm wide, the source-to-gate distance was $(1.5-2) \cdot 10^{-4}$ cm and the source-to-drain distance was varied over a wide range in each. Current-voltage characteristics were measured through the operating range into the cut-off range. Glow "spots" with attendant irreversible changes in the interelectrode (drain-gate) region were recorded before and during breakdown. Breakdown of the drain domain was found to be preceded by melting of gallium in the brightest spots in this region and migration of the liquid toward the gate, after formation of craters in the n-GaAs film from which drops of liquid gallium had exuded to settle on the surface. Breakdown of the Schottky barrier was found to be preceded by isothermal instability with attendant redistribution of the electric field in the drain-gate region. The authors thank S. N. Boldyrev for examining the specimens under a raster electron microscope. Figures 2, references 5:
4 Russian, 1 Western.
[190-2415]

LIFETIME OF EXCESS CHARGE CARRIERS IN WEAKLY DOPED EPITAXIAL GaAs LAYERS

Leningrad FIZIKA I TEKHNIKA POLUPROVODNIKOV in Russian Vol 17, No 11, Nov 83
(manuscript received 9 Jun 83, signed to press 16 Jun 83) pp 1953-1956

GRIGOR'YEV, B. I., DANIL'CHENKO, V. G. and KOROL'KOV, V. I., Physicotechnical
Institute imeni A. F. Ioffe, USSR Academy of Sciences, Leningrad

[Abstract] The effective lifetime of excess charge carriers in weakly doped epitaxial GaAs diode structures was determined experimentally under conditions of large current with attendant wide modulation of the bulk electrical conductance of the base layer. Specimens of six different structures $p^+-p^0-n^+$ structures with homojunctions, $p^+-n^0-n^+$ structures with p^+-n^0 heterojunction, $p^+-n^0-n^+$ structures with homojunctions, p^+-n^0-R structures without n^+ -layer but with ohmic contact, $n^+-p^0-p^+$ structures with homojunctions, and n^+-p^0-R structures without p^+ -layer but with ohmic contact, were produced by epitaxial growth from the liquid phase. The effective lifetime was determined by the difference method, this method completely eliminating the errors caused by nonideality of the emitter and finite width of the base, buildup of quasi-electric fields in the base region, and other factors. The gist of the method was measuring the intervals of time during which the reverse current remained constant at two amplitude levels differing by the factor e while the amplitude of the forward current had remained at the same level in each case, and then calculating the effective life-time as the difference of these two time intervals. The measuring instruments had been specially designed for the 0.05-100 μ s range of lifetime, with amplitudes of the forward current in the 0.05-2 A range, the ratio of reverse current to forward current amplitudes 0.05 or 0.05/ e , duration of the forward current up to 200 μ s, and a 20 ns duration of current transition from forward to reverse. From the experimental data have been plotted the dependence of effective lifetime on density of the forward current at various temperatures, found to be the same for all structures, and the dependence of the saturation current density on the impurity concentration in the base region. An analysis and theoretical interpretation of the results indicates predominance of the nonradiative recombination mechanism and a dependence of the effective lifetime on the injection level. The effective lifetime either did not change or increased slightly as the temperature was raised from 20 to 160°C. The authors thank V. G. Nikitin and M. N. Stepanov for the experimental specimens, and A. A. Yakovenko for useful discussions. Figures 2, references 9: 8 Russian, 1 Western (in Russian translation).
[190-2415]

IMPURITY PHOTOCURRENT UNDER CONDITIONS OF THERMAL OVERCHARGING OF DEEP CENTER

Leningrad FIZIKA I TEKHNKA POLUPROVODNIKOV in Russian Vol 17, No 11, Nov 83
(manuscript received 14 Apr 83, signed to press 27 Jun 83) pp 1966-1969

BOBYLEV, B. A. and KRAVCHENKO, A. F., Institute of Semiconductor Physics,
Siberian Department, USSR Academy of Sciences, Novosibirsk

[Abstract] The behavior of the impurity photocurrent under conditions of thermal overcharging of deep centers is analyzed on the basis of an analogy between this photocurrent and the transient current in a structure with a depletion region. The corresponding equation of electron kinetics and the equation of current as a function of time for a high-resistivity specimens such as a hole trap under constant bias, with the rates of optical emission of electrons and holes e_n^o , e_p^o in the coefficients, yield an expression for the photocurrent at the end of the transient period at low temperatures ($e_{n,p}^o \gg e_p^t$) and at high temperatures ($e_{n,p}^o \ll e_p^t$) (e_p^t - rate of thermal emission of holes) as well as an expression for the steady-state impurity photocurrent after the end of an optical excitation pulse. From the resulting relation for the net thermoemission current is calculated the concentration of deep centers. From experimental data is established the temperature dependence of the net (difference) hole thermoemission current and of the photocurrent pulse form. The main characteristic feature of the impurity photocurrent is a narrow peak within the 200-230 K range, which can be used as a detector of deep centers as well as for determining the optical cross sections for their photoionization and photoneutralization at the wavelength of the exciting light. The authors thank V. I. Korzhov and V. I. Saptsov for assisting with the experiment. Figures 3, references 7: 1 Russian, 6 Western.
[190-2415]

DISTRIBUTION OF FRENKEL PAIRS FORMED IN GERMANIUM DURING IRRADIATION WITH RESPECT TO DISTANCE BETWEEN MEMBERS

Leningrad FIZIKA I TEKHNKA POLUPROVODNIKOV in Russian Vol 17, No 11,
Nov 83 (manuscript received 15 Jun 83, signed to press 29 Jun 83) pp 1985-1990

VITOVSKIY, N. A., YEMISEV, V. V. and MASHOVETS, T. V., Physicotechnical
Institute imeni A. F. Ioffe, USSR Academy of Sciences, Leningrad

[Abstract] An experimental and theoretical study was made for the purpose of determining the causes of inconsistency between the small cross section for formation of Frenkel pairs in germanium exposed to cold ($T \lesssim 10$ K) gamma radiation and the nonlinear dependence of pair concentration on irradiation dose, as well as between effects of electron bombardment and gamma irradiation at equal energy levels and comparable intensity levels. In the experimental

part, gamma radiation was produced by a ^{60}Co source equivalent to a source of 1 MeV fast electrons, assuming the maximum energy of photoelectrons and of Compton electrons to be 1.32 MeV and 0.96 MeV, respectively. Specimens of Ge <P>, Ge <As>, Ge <Sb> were gamma-irradiated at 6.5 K with an intensity of $3 \cdot 10^{12}$ kW/(cm 2 ·s), or electron-bombarded at 10 K with an intensity of 1.25 nA/cm 2 . A hypothetical energy-band structure of a vacancy representing a primary defect and of an interstitial atom serves as a basis for a theoretical analysis of the evolution of their energy spectra with decreasing atom-vacancy distance. The specimens were cold annealed at temperatures $T \geq 30$ K after gamma irradiation, or $T \gtrsim 60$ K after electron bombardment. The attendant process of Frenkel pair annihilation in n-Ge is analyzed theoretically on the basis of a system of k first-order differential equations for the rates of change of pair concentrations during k jumps of an interstitial atom, each resulting from a single overcharge by hole capture. This system of equations is transformed to one of k-th order not containing unknown parameters. The results of such an interpretation reconcile previous experimental data and indicate that the distribution of Frenkel atom-vacancy pairs with respect to the atom-vacancy distance is determined by the characteristics of the irradiated or bombarded material, also that this distribution depends only on the kind and the energy of incident stimulus. The authors thank L. V. Mizrukhin for participation and discussions. Figures 3, references 15: 9 Russian, 6 Western. [190-2415]

UDC 621.315.592

CATHODOLUMINESCENCE OF $\text{Al}_x\text{Ga}_{1-x}\text{As}$ SOLID SOLUTIONS OF VARIABLE COMPOSITION

Leningrad FIZIKA I TEKHNIKA POLUPROVODNIKOV in Russian Vol 17, No 11, Nov 83 (manuscript received 29 Jun 83, signed to press 5 Jul 83) pp 2013-2017

DRYAPIKO, N. K., PEKA, G. P. and CHUMAK, S. M., Kiev State University imeni T. G. Shevchenko

[Abstract] An experimental study of $\text{Al}_x\text{Ga}_{1-x}\text{As}$ solid solutions was made for the purpose of determining their recombination parameters by the cathodoluminescence method. Specimens of n-type $\text{Al}_x\text{Ga}_{1-x}\text{As}$ ($x \leq 0.36$) variband layers were produced by epitaxial growth from the liquid phase, in a container with a melt solution, on substrates of GaAs Pb single crystals with an electron concentration $n \sim 5 \cdot 10^{17}$ cm $^{-3}$ and an orientation in the (100) plane. The layers were doped specially or with phosphorus, their composition varied along the growth axis from $x = 0.36$ at the boundary with the substrate to $x = 0$ at the free surface. The variband layers were 20-150 μm thick, had an equilibrium electron concentration $n \sim 10^{16}$ - 10^{17} cm $^{-3}$ and an electron mobility $\mu_e = (3-4) \cdot 10^3$ cm 2 /(V·s) at 300 K. The intensity of the built-in quasi-electric field was indicated by the location of the peak of edge photoluminescence during excitation and recording of photoluminescence from the narrow-band side with "straight" oblique (0.1-2° angle) ground facets. Luminescence was excited by means of a scanning electron beam 0.05 μm in diameter. The electron beam was produced

by an accelerating voltage of 5-39 kV, its power being held constant by means of current regulation. The scanning speed was such as to ensure steady cathodoluminescence, the latter being measured with an FD-24K silicon photodiode. Control measurements of the recombination parameters by the photoluminescence method were made on the same specimens. The experimental data have been evaluated and interpreted on the basis of theoretical relations for cathodoluminescence excitation spectra and the effective depth of electron beam penetration, yielding the referred surface recombination rate and the diffusion-drift distance as functions of the layer composition aluminum content x). The cathodoluminescence method of determining the recombination parameters offers two advantages over the photoluminescence method, namely better localization of measurement with a thin electron beam as a probe and simultaneous coverage of the entire area of an oblique facet with a scanning electron beam. The authors thank S. A. Nepiyko for facilitating measurements under a JSM-35 raster electron microscope. Figures 3, tables 1, references 5: 2 Russian, 3 Western.
[190-2415]

UDC 621.315.592

SPLITTING OF FINE-STRUCTURE COMPONENTS OF LINES IN PHOTOELECTRIC SPECTRUMS OF EPITAXIAL GaAs LAYERS IN MAGNETIC FIELD

Leningrad FIZIKA I TEKHNIKA POLUPROVODNIKOV in Russian Vol 17, No 11, Nov 83 (manuscript received 28 Feb 83, signed to press 16 Jul 83) pp 2050-2054

IVANOV, V. Yu. and LIFSHITS, T. M., Institute of Radio Engineering and Electronics, USSR Academy of Sciences, Moscow

[Abstract] A study of epitaxial GaAs layers was made by laser-magnetic photoelectric spectroscopy, for a determination of the impurity states from the line spectrum of photoconduction resulting from optical excitation and subsequent thermal ionization of impurities. In some specimens individual components of fine-structure photoconduction lines corresponding to the optical transition $1s - 2p, +1$ were found to be noticeably split. Those corresponding to the optical transition $1s - 3p, +1$ were also found to be split in the same specimens at the same peaks, but less intensely. This phenomenon is now interpreted as an apparent one which represents dipping of a peak top, only when some corresponding impurity atoms contribute to photoconduction while absorbing radiation. This apparent splitting is attributed here to an interaction mechanism, not a dipole-dipole or exchange interaction, neither of them fitting the evidence, but electron-electron interaction of neighboring neutral donors: one in the ground state and one in the excited state. The authors thank V. M. Zaletin, A. I. Toropov, A. T. Dudarev, L. D. Sabanova, A. A. Telegin for supplying the specimens, and Ye. F. Astakhova for consultations and assistance concerning deposition of high-quality contacts on epitaxial layers. Figures 3, references 21: 7 Russian, 14 Western.
[190-2415]

NEW EDGE RADIATION SERIES OF CdS IN ELECTRIC FIELD

Leningrad FIZIKA I TEKHNIKA POLUPROVODNIKOV in Russian Vol 17, No 11, Nov 83
(manuscript received 21 Jun 83, signed to press 29 Jun 83) pp 2086-2088

GRIN', V. F., RIZAKHANOV, M. A., SHEYNKMAN, M. K. and SHEPEL'SKIY, G. A.,
Dagestan State University imeni V. I. Lenin, Makhachkala

[Abstract] Two series of green short-wave edge radiation existing in CdS at low temperatures, each consisting of a phononless line and its phononic train, were found to become split in an electric field. Experimental data confirm the significant role of the 2p and 1s states of fine $E_c - 0.03$ eV donors in generation of these, as well as the long-wave edge series, through pairwise collaboration with deep $E_v + 0.17$ eV acceptors in radiative interimpurity transitions. The splitting of the short-wave edge series is attributed here to the Stark effect at 2p levels of a fine donor which participates in corresponding optical transitions. This mechanism appears more likely than the interaction also possible of the electric field with photoluminescence. The new series is thermally stable, with only a slight shift of bands, and appears at temperatures corresponding to a mean thermal energy close to the ionization energy of fine donors. Such donors are not likely to capture charge carriers, and switching of the recombination channel from a "2p-state \rightarrow deep acceptors" interimpurity one to a "c-band \rightarrow deep acceptors" band-impurity one with rising temperature explains the retention by CdS crystals of their luminescence up to high temperatures. The authors thank V. A. Khvostov and V. A. Babentsov for discussion and helpful comments. Figures 1, references 3: 2 Russian, 1 Western.

[190-2415]

ELECTROPHYSICAL AND OPTICAL PROPERTIES OF POROUS SILICON

Leningrad FIZIKA I TEKHNIKA POLUPROVODNIKOV in Russian Vol 17, No 11, Nov 83
(manuscript received 25 Apr 83, signed to press 5 Jul 83) pp 2090-2093

BILENKO, D. I., ABAN'SHIN, N. P., GALISHNIKOVA, Yu. N., MARKELOVA, G. Ye.,
MYSENKO, I. B. and KHASINA, Ye. I., Scientific-Research Institute of Mechanics
and Physics, Saratov State University imeni N. G. Chernyshevskiy, Saratov

[Abstract] Electrophysical and optical properties of porous silicon were measured in an experimental study, this material having important practical applications because it combines structural perfection of microparticles with disorder of pores. Specimens of 1-10 μm thick layers were produced by anodic treatment with hydrofluoric acid of n-type and p-type silicon single crystals having an electrical resistivity of 0.002-1 ohm.cm, some specimens having been thermally oxidized in part. Their electrical conductivity, Hall coefficient, reflection and transmission coefficients were measured over a wide

frequency range covering plasma resonance, and their complex dielectric permittivity was measured in the high-frequency range. An interpretation of the results on the basis of a matrix model with variable pore shape and silicon content, with the aid of the appropriately modified Maxwell-Garnett relation, reveals that porous silicon has a lower electrical conductivity and a higher Hall coefficient than the bulk material. As the porosity increases, the electrical conductivity decreases and the Hall coefficient increases while the refractive index decreases slightly and the absorption coefficient decreases appreciably in the infrared range (2-2.5 μm wavelengths). The spectral characteristic of the reflection coefficient of porous silicon is similar to that of silicon plasma, but its minimum shifts toward lower frequencies. A change in the interphase boundaries and an increase of the oxide fraction cause a change in the complex dielectric permittivity at frequencies within the 10^4 - 10^{15} Hz range. Buildup of porosity is accompanied by a decrease not only of the total-volume mean charge carrier concentration but also of the charge carrier concentration in residual silicon microparticles. Capture of charge carriers by the enlarged surface and preferential etching of silicon microregions with higher impurity content, rather than neutralization of impurity, are the most likely mechanisms of both reversible and irreversible concentration changes. Figures 2, references 6: 4 Russian, 2 Western. [190-2415]

UDC 621.315.592

EFFECT OF MAGNETIC FIELD ON COURSE OF IONIZATION PROCESSES ACTIVATED BY ELECTRONS IN UPPER VALLEYS OF c-BAND IN GaAs

Leningrad FIZIKA I TEKHNIKA POLUPROVODNIKOV in Russian Vol 17, No 11, Nov 83 (manuscript received 20 May 83, signed to press 5 Jul 83) pp 2093-2095

VOROB'YEV, Yu. V., LOKTEV, Ye. V., FILINA, L. I., TSYUPA, A. M. and SHEYNKMAN, M. K., Institute of Semiconductors, UkSSR Academy of Sciences, Kiev

[Abstract] An experimental study has confirmed an earlier expectation that a magnetic field will influence ionization of deep levels in GaAs, and in structurally similar InP, by electrons falling into the upper (lateral) valleys of the c-band as the result of a specific Auger process with possible amplification by an electric field. A magnetic field of 2 kG strength was applied to specimens of GaAs <Cr>. Traps at 0.20, 0.24, 0.28 eV depths were occupied by electrons at τ_k , the duration of optical excitation corresponding to the time of maximum occupancy. The concentration of electrons stored on traps during excitation was measured by the method of thermally stimulated electrical conductivity. Ionization and the effect of an electric field on it were detected by repeating the test with an alternating electric field applied during the final stage of excitation, this electric field with an amplitude above the threshold level of 250 V/cm causing a decrease of the electron concentration on traps. A comparison of the results with those obtained without a magnetic field reveals that the latter, in a first approximation, shifts the entire ionization curve in the direction of higher electric

field intensities. An unexpected feature of this effect is that it is produced not only by a magnetic field perpendicular to the electric field but also by a parallel one. This indicates either an anisotropy of Γ -valleys within the $E \approx \Delta E_{\Gamma-X}$ energy range or a nonhomogeneity of GaAs <Cr> crystals. The magnitude of the magnetic field is estimated on the basis of both factors. The authors thank A. Matulenis for helpful discussion. Figures 2, references 8: 7 Russian, 1 Western.
[190-2415]

UDC 535.21

NONTHERMAL MECHANISM FOR LASER ANNEALING OF SEMICONDUCTORS AND FORMATION OF SUPER STRUCTURE

Moscow MIKROELEKTRONIKA in Russian Vol 12, No 6, Nov-Dec 83
(manuscript received 22 Apr 83) pp 499-511

KAPAYEV, V. V., KOPAYEV, Yu. V. and MOLOTKOV, S. N., Physics Institute, USSR Academy of Sciences

[Abstract] A phase transition in a metal state under the influence of a powerful electromagnetic field, on the basis of which is described a nonthermal mechanism for laser annealing, is proposed for semiconductors with a diamond lattice. The paper is concerned with an investigation, based on a description of models, of the possibility of forming a macroscopic superstructure which experimentally is observed in a limited interval with respect to intensity. The model is described. For an accurate description of an unbalanced phase transition from the semiconductor state into the metallic under the effect of radiation, a common solution is necessary of the kinetic equation for the unbalanced quasi-fraction, an equation of state describing the metallic and semiconductor phases, and the Maxwell equation. In such a statement, solution of the problem is very complicated and is possible only by numerical methods. Consequently, in this paper it is limited to a linear analysis of the stability of a homogeneous semiconductor state. The distinctive features are listed of the experiments on laser annealing with short radiation pulses ($< 10^{-8}$ s) which it was possible to realize within the scope of the proposed method. Figures 4, references 34: 21 Western (1 in Russian translation), 13 Russian.
[177-6415]

INVESTIGATION OF EFFECT OF PHOTOCURRENT AMPLIFICATION IN METAL-DIELECTRIC-SEMICONDUCTOR STRUCTURES BASED ON SILICON

Moscow MIKROELEKTRONIKA in Russian Vol 12, No 6, Nov-Dec 83
(manuscript received 15 Feb 83) pp 535-539

NAGIN, A. P., NIKITIN, I. O., and TYUL'KIN, V. M.

[Abstract] The nature of the effect of the considerable photocurrent amplification (up to 10^3 and more) in MDP (metal-dielectric-semiconductor) structures based on silicon is investigated. It is established that in a regime of volumetric, reversible avalanche multiplication of photocarriers, the amplification factor of the photocurrent is not more than 50, and the necessary condition for observation of large values of the amplification factor is the presence of steady leakage current through the structure. Assuming that the steady leakage current flows in channels with small dimensions which originate in the dielectric of the MDP structure under the effect of the strong electrical field applied to it, the effect of amplification can be explained by the origination of a situation similar to that which exists in a vertical transistor and leads to a considerable amplification of the photocurrent in it. The large values of the amplification factor of the photocurrent are unstable in time and this operating condition of the MDP structure is accomplished by irreversible changes of the dielectric conductivity. For this reason use of MDP structures as photodetectors can prove to be of little promise because of their very low reliability. However, as follows from developed models, this situation can change if especial creation of a "porous" dielectric with stable conductive channels of sufficiently small dimensions is successful. Figures 5, references 5: 1 Western, 4 Russian.
[177-6415]

DYNAMIC CLASSIFICATION OF OBJECTS IN MULTILAYER NEUROLIKE STRUCTURES

Moscow MIKROELEKTRONIKA in Russian Vol 12, No 6, Nov-Dec 83
(manuscript received 14 Jun 82) pp 573-579

SHKVAR, A. M. and SVECHNIKOV, S. V., Semiconductor Institute, UkSSR Academy of Sciences

[Abstract] The paper investigates one of the possible methods of functioning of neurolike automatic devices, based on a hypothesis advanced by the authors, of the functional expediency of the dynamic activity of the brain's neuron structure. The nonformal automatic devices considered, based on multilayer neurolike structures, can be realized using neurolike elements with different degrees of formalization of the properties of a biological neuron. A certain neurolike network is considered which is by no means a model for a biological neuron network, but makes it possible to show how the dynamic processes

participate in the capacity of the most important and integral attribute of the process of classification of objects. The results are shown of modelling on a digital computer of the process of instruction of the classifier used, with various initial data. Experimental investigations of the simplest variation of the automatic devices described are presented. Figures 2, references: 6 Russian.
[177-6415]

UDC 537.311.322

CONCERNING EFFECT OF FLUORINE IONS ON PROPERTIES OF STRUCTURE OF GALLIUM-ARSENIDE--ANODIC OXIDE

Moscow MIKROELEKTRONIKA in Russian Vol 13, No 2, Mar-Apr 84
(manuscript received 21 Mar 83) pp 157-160

LYASHENKO, A. V., TARANTOV, Yu. A., and KONOROV, P. P., Leningrad State University

[Abstract] In this paper, using the methods of ellipsometry, x-ray photoelectron spectroscopy, and volt-farad characteristics, an investigation is made of the composition and electrophysical properties of the structure of GaAs--Anodic oxide films (AOP) grown in an electrolyte in the presence of fluoride ions. Anode oxidation of gallium arsenide in an electrolyte in the presence of fluorine ions leads to a decrease of the concentration of elementary arsenic at the boundary gallium-arsenide--anode oxide, and accordingly to a reduction of the density of the surface states in comparison with structures obtained in electrolyte without fluorine. The authors also point out that in AOP, alloyed by fluorine ions, a positive charge is discovered, resulting from capture of holes at the traps. Previously, capture of holes was also observed by the authors in the case of a structure obtained in electrolyte without fluorine ions. In the two cases, the density and cross section of the hole capture amount to $\sim 5.5 \cdot 10^{12}$ and $\sim 5 \cdot 10^{-13}$, respectively. However, if in the first instance the density of the holes was decreased after annealing, and in the case of the structure of GaAs-AOP alloyed by fluorine, annealing would not effect it. The authors express their thanks to A. P. Baraban for assistance during study of the electro-physical properties of the structure investigated, Yu. P. Kostikov and Ye. G. Kuz'min for stripping the x-ray photoelectron spectra, and A. I. Gromov for assistance during conduct of the ellipsometric investigation. Figures 2, references 10: 7 Russian, 3 Western.
[205-6415]

CHANGE OF PROPERTIES OF NEAR SURFACE LAYER OF SILICON CRYSTALS DURING
PROLONGED HIGH-TEMPERATURE PROCESSING

Moscow MIKROELEKTRONIKA in Russian Vol 13, No 2, Mar-Apr 84
(manuscript received 15 Jan 82) pp 161-164

ASTAKHOV, V. P., GALKIN, M. G., DUDNIK, V. Ya., KAZARINA, N. N., LIFSHITS,
T. M., STOYANOVA, I. G., STRUKOV, F. V. and TAUBKIN, I. I.

[Abstract] It is shown that prolonged processing (4-90 hours) of a plate of stock silicon at a temperature of 1130-1200° C in SDO-125/3 and SDO/125/4 diffusion furnaces, within quartz tubes and a nitrogen atmosphere, leads to a change of the properties of the near surface region of crystals, notable forming of a surface p-layer. The plates loaded in the furnace were cut from ingots, and were subjected to grinding, chemical-dynamic polishing, and washing; impurity atoms were especially not introduced into them. Tubes and equipment produced from Mark KI quartz (TU21RSFSR 560-77) were used in the experiments. The data from the spectrometric analysis did not make it possible to evaluate the boron content in this quartz (sensitivity of method $\sim 10^{17} \text{ cm}^{-3}$). However, from the results of check experiments with respect to heat treatment in a silicon ampoule it follows that the concentration of boron in Mark KI quartz corresponds to the concentration of boron atoms in the material of the ampoule and amount to $\sim 10^{14} \text{ cm}^{-3}$. Figures 2, references 11: 6 Russian, 5 Western (2 in Russian translation).
[205-6415]

MATHEMATICAL MODELING OF ASSEMBLY PROCESSES INVOLVING USE OF SENSITIZED ROBOTS

Moscow IZVESTIYA AKADEMII NAUK SSSR: TEKHNIЧЕСКАЯ KIBERNETIKA in Russian No 1, Jan-Feb 84 (manuscript received 13 Jul 82) pp 148-157

BURTSEV, A. A. and SOLNTSEV, V. I., Moscow

[Abstract] Force-moment sensitization of the automatic manipulator is essential for robotization of assembly processes, one of the basic operations being assembly of "shaft - sleeve" pairs. For the purpose of process analysis and subsequent manipulator synthesis, a mathematical model of force-moment interaction in such a pair has been constructed so as to close the system of equations of manipulator dynamics. This model is a quasi-dynamic one, simulating the dynamics of steady states, and is based on a plane kinematic scheme of force and moment measurements. Although placing the transducers on the manipulator tongs is technologically preferable, for greater versatility, placing them on the assembly table ensures better accuracy and is more convenient. The latter configuration has been selected for modeling, but both are mathematically equivalent. Shaft and sleeve are assumed to be perfectly rigid, the shaft diameter is smaller than the sleeve diameter, and the kinematic couplings are ideal. The manipulator positioning is sufficiently precise to ensure that the shaft will slide into the sleeve. The model covers the four possible modes of shaft entrance: 1) two points of contact (shaft touches the sleeve edge on one side and the opposite sleeve wall inside); 2) one point of contact (shaft touches the sleeve edge but clears the opposite sleeve wall inside); 3) one point of contact (shaft clears the sleeve edge but touches the opposite sleeve wall inside); 4) no point of contact (shaft clears both the sleeve edge and the opposite sleeve wall inside). The algorithm of solving the equations of dynamics for each case has been programmed in FORTRAN. Calculations for vertical feed with a positioning accuracy within $\pm 10 \mu\text{m}$ in a typical machine tool with numeric program control agree closely with experimental data pertaining to low feed rates. For high feed rates it becomes necessary to refine the mathematical model by taking transient effects into account. The authors thank Professor P. D. Krut'ko, doctor of technical sciences, for assistance. Figures 5, references: 5 Western (1 in Russian translation).

[187-2415]

OPTIMIZATION OF MOVEMENTS OF MANIPULATORS WITH KINEMATIC REDUNDANCY

Moscow IZVESTIYA AKADEMII NAUK SSSR: TEKHNICHESKAYA KIBERNETIKA in Russian
No 1, Jan-Feb 84 (manuscript received 7 Sep 82) pp 158-166

KAPLUNOV, A. A., Moscow

[Abstract] A manipulator with n degrees of freedom is considered, in a system of n generalized coordinates, and two problems concerned with its movement optimization are formulated. The first problem is to minimize the time of load transfer within the manipulator range from initial state to final state by selecting the vector of generalized manipulator coordinates which will accomplish this, with the initial vector of generalized manipulator coordinates and the final vector of generalized load coordinates given. The second problem is to minimize the time of load transfer within the manipulator range from initial state to final state by selecting the initial vector and the final vector of generalized manipulator coordinates which will accomplish this, with the initial vector and the final vector of generalized load coordinates given. Both problems are reformulated and solved specifically for manipulator arms of two industrial robots: "Universal-5" and "RPM-25". The former has six independent degrees of freedom, four for transport operations and two for tong (wrist) orientation. The latter is anthropomorphous and has five independent degrees of freedom, three for transport operations and two for tong (wrist) orientation. Kinematic redundancy of the manipulators and interchangeability of positions cause ambiguities in the determination of generalized coordinates from given Cartesian ones. Numerical solution of the problems for various specific values of linear and angular coordinates has yielded results which agree closely with experimental field data on both manipulators and indicate that optimization of manipulator movements gives a significant payoff in time saving. The author thanks F. L. Chernous'ko and N. N. Bolotnik for interest in the study, discussion of the results, and valuable comments. Figures 8, references: 2 Russian.
[187-2415]

UDC 62-50

CONTROLLING ROTATION OF ELASTIC MANIPULATOR LINK

Moscow IZVESTIYA AKADEMII NAUK SSSR: TEKHNICHESKAYA KIBERNETIKA in Russian
No 1, Jan-Feb 84 (manuscript received 7 Jun 82) pp 167-173

AKULENKO, L. D. and BOLOTNIK, N. N., Moscow

[Abstract] The problem of controlling the rotation of an elastic manipulator link is analyzed by treating such a link as a thin straight inextensible beam of a homogeneous material with a uniform cross section and assuming that it rotates about a stationary axis driven by a moment of force. The two integro-differential equations of motion, respectively describing elastic oscillations

relative to an undeformable reference and change in angular momentum relative to the axis of rotation, are reduced to partial differential equations. The corresponding boundary-value problem is solved for a programmable control torque as an explicit function of time, with necessary suppression of residual elastic oscillations at the end of the braking process. After a general exact analytical solution has been obtained, the control function is assumed to be piecewise-continuously differentiable during a cycle consisting of linear increase and linear decrease of the torque with direction reversal and with a constant-torque time interval between each increase and decrease. On the basis of this approximate solution, the minimum time necessary is then determined for "approximate" (in terms of piecewise continuity) and oscillation-free transfer of the link as a mechanical system from its initial state to its final state by the given mode of control. An analysis of the solution indicates how this minimum time depends on two parameters of the control: rate of change of torque and magnitude of torque during constant-torque period. Figures 2, references 11: 10 Russian, 1 Western. [187-2415]

UDC 62-50

CONTROL OF LINEAR STATIONARY OBJECTS SUBJECT TO EXTERNAL ACTIONS BY MEANS OF VARIOUS TYPES OF FEEDBACK

Moscow IZVESTIYA AKADEMII NAUK SSSR: TEKHNIЧЕСКАЯ KIBERNETIKA in Russian No 1, Jan-Feb 84 (manuscript received 9 Feb 82) pp 174-182

YEMEL'YANOV, S. V., KOROVIN, S. K. and ULANOV, B. V., Moscow

[Abstract] An automatic control with finite parameters in all regulation loops, capable of operating without measurement of external actions and without slippage, is synthesized for a certain class of dynamic objects describable by a system of nonhomogeneous equations. The problem is solved by reducing the nonhomogeneous part of these differential equations to zero and finding the control $u = u^x + u^z$ which will make the solution to the vector equation of the object $\dot{x} = v(x, u, f)$, either independent of or only limitedly dependent on the external actions ($x = (x_1, \dots, x_n)^T$ - vector of phase coordinates, $v = (v_1, \dots, v_n)^T$ - vector of phase velocity whose components depend on vector x , control vector $u = (u_1, \dots, u_n)^T$, and vector-function of time $f(t) = (f_1(t), \dots, f_l(t))^T$). This method works only when the vector equation $\dot{x} = v(x, u, f)$ of the object in the phase space is reducible to a system of equations of the $\dot{x}_i = \varphi_i(x, u^x, \{\mu, \nu, \dots\}) + \psi_i(\omega, F_i)$ (φ_i, ψ_i - some functions, $F_i(t)$ - function of time which depends on the components of the vector of external action $f(t)$, $\omega = \{u, \nu, \dots\}$ - parameters). The method is demonstrated on control for linear dynamic objects with steady parameters and describable by a single differential equation $x^{n-m} + \sum_{i=0}^{n-m-1} b_i x^i = z + f(t)$ ($z = (z_1, \dots, z_n)$ - vector of

output coordinates of servomechanism at input to control object carrying information about external actions, $b_i (i = 0, 1, \dots, n-m-1)$ - constant parameters).

With the law of variation of the adjustable parameter properly selected, the problem reduces to controlling a dynamic object with variable parameters and its solution is a continuous coordinate control u^x . This law of parameter variation is established on the basis of three theorems constraining the parameter and defining the upper bound for its variation. Figures 1, references: 9 Russian. [187-2415]

SYNTHESIS OF CONTROL FOR NONLINEAR SYSTEMS WITH EQUALITY-TYPE CONSTRAINTS ON PHASE COORDINATES

Moscow IZVESTIYA AKADEMII NAUK SSSR: TEKHNIЧЕСКАЯ КИБЕРНЕТИКА in Russian No 1, Jan-Feb 84 (manuscript received 6 May 81) pp 183-187

KIRSANOV, A. P., Moscow

[Abstract] A control is synthesized for a dynamic object describable by the system of differential equations $\dot{x} = f(x, u)$ (x - n -dimensional state vector, u - m -dimensional control vector), with the constraint $F(x) = 0$ on the relation between components of the state vector along the trajectory (F - s -dimensional continuously differentiable vector-function defined in state space of the control object). The problem is to find a control law $u(x)$ which will make the trajectory $x(t; u)$ of the closed system satisfy the constraints

$$F(x(t; u)) = 0 \text{ at every time } t \geq t_0, \text{ if } F(x(t_0; u)) = 0$$

or

$$F(x(t; u)) \rightarrow 0 \text{ as time } t \rightarrow \infty, \text{ if } F(x(t_0; u)) \neq 0$$

The first constraint is equivalent to an invariant manifold M of the closed system. The second constraint is, with additional constraints on F and $x(t; u)$, equivalent to having the trajectory asymptotically approach the target manifold M . The method of solving the given control synthesis problem is based on this geometrical interpretation of constraints. The manner in which the state point of the closed system approaches the target manifold M and the manner in which the function $\varphi(t) = F(x(t; u))$ approaches zero depend on the choice of the stable matrix L in the equation $F_x(x)f(x, u) = LF(x)$. The control which satisfies this equation is the solution to some system of ordinary differential equations and is found by letting $F_x(x)f(x, u) - LF(x) = G(x, u)$. Practical application of this method of control synthesis is demonstrated by putting a material point which moves in a plane in a central (gravitational) force field into a circular orbit. This is an example where the problem can be solved analytically. Figures 1, references: 5 Russian. [187-2415]

OPTIMIZATION OF SEARCH OF OBJECT MOVING CYCLICALLY ALONG CLOSED TRAJECTORY

Moscow IZVESTIYA AKADEMII NAUK SSSR: TEKHNICHESKAYA KIBERNETIKA in Russian
No 1, Jan-Feb 84 (manuscript received 12 Aug 81) pp 188-198

VENIAMINOV, S. S., Moscow

[Abstract] An object is considered which moves cyclically along a closed plane trajectory, its law of motion being a periodic function of time $[s(t)]_{\text{mod } S} = [s(t+nT)]_{\text{mod } S}$ ($\forall t, \forall s$) (t - time, T - period, s - sought coordinate of object, S - change of position coordinate in one cycle, n - arbitrary positive integer). The problem of optimizing the search of this object is solved by the method of equivalence curves, such a curve being the geometric locus of points $\langle t, s \rangle$ in plane (ts) equivalent to some arbitrary fixed point $\langle t_0, s_0 \rangle$ and every point $\langle t, s \rangle$ representing the reading of its coordinate s at instant of time t . After the relevant properties of a family of equivalence curves for a fixed instant of time t_0 have been established, a theorem is proved, with the aid of three lemmas, which establishes the optimum conditions for the general case of search with one instrument within one cycle of motion. In one special case this theorem is also applicable to an arbitrarily long search time, namely when $s_t' [s_m - \Delta s] = s_t'' [s_m + \Delta s]$. The analysis is then extended to optimal and suboptimal searches with a group of instruments. A practical application of this method of search optimization is tracking an artificial earth satellite, specifically its latitude, with the use of ephemerides. The inaccuracy of ephemerides because of nonideality of physical models must be taken into account. As a typical example, three astronomical observation points are assumed to be available during three nights. A tree of successive approximate solution to the tracking problem is plotted with application of truncating rules. The last branch yields the exact solution and the corresponding value of the estimation functional. Figures 7, references 3: 2 Russian, 1 Western.
[187-2415]

UDC 681.32.001

IMPLEMENTATION OF PLANAR LOGIC WITH EXTERNAL ACCESS

Moscow IZVESTIYA AKADEMII NAUK SSSR: TEKHNICHESKAYA KIBERNETIKA in Russian
No 1, Jan-Feb 84 (manuscript received 17 Jun 81, after completion 25 Apr 83)
pp 199-201

BITYUTSKIY, V. P. and NEKRASOV, V. P., Sverdlovsk

[Abstract] A planar logic circuit is defined as one without crossing interconnections between elements. The problem is to construct such a logic circuit with external access, equivalent to an originally synthesized generally nonplanar one which implements some set of Boolean functions. The arrangement

of terminals along the outer edge is assumed to be given. The method of solving this problem involves subdividing the graph which corresponds to the original circuit into bilobar graphs and then minimizing the number of crossings in the latter successively in all tiers. A maximum (2,2)-terminal network connected to a pair of crossing interconnections is defined as the one containing the largest number of elements. A theorem that only one such (2,2)-terminal network exists which contains any given crossing is stated and proved, as a basis for replacing the nonplanar (2,2)-terminal networks rather than only the crossings they contain with planar ones. The array of planar (2,2)-terminal networks is found in a catalog of minimum ones on a NOR or NOT base obtained by permutations on a BESM-6 high-speed computer. The redundancy in such an array is determined from the planarity factor, namely the ratio of the number of elements in the planar circuit to that in the nonplanar one. The method was tried experimentally with randomly constructed nonplanar NOR logic circuits and arbitrary arrangements of terminals. Figures 3, references 12: 11 Russian, 1 Western.
[187-2415]

UDC 681.3

SYNTHESIS OF PROGRAMMABLE LOGIC ARRAYS WITH EASY DIAGNOSTIC TESTING

Moscow IZVESTIYA AKADEMII NAUK SSSR: TEKHNICHESKAYA KIBERNETIKA in Russian No 1, Jan-Feb 84 (manuscript received 17 Feb 83) pp 201-206

GORYASHKO, A. P., Moscow

[Abstract] A modification of programmable logic arrays is proposed which allows continuous detection of faults and shorts by means of an easy $N+m$ test set (N - total number of conjunctive terms, m - number of implemented logic functions), not depending on the form of the implemented logic functions. The modification, while not universal, is rather simple and based on a 3-level structure. The validity of this modification follows from a theorem that any $\pi(n, N, m)$ system ($f_{n, m}$ - Boolean vector function) can be modified into an $\pi'(n', N', m')$ system implementing the same set of functions at m outputs with a test length $\lceil \log_2 N \rceil \leq T(\pi') \leq N+m+n+1 \lceil \log_2 n \rceil + 1$. The theorem is proved in two steps for $N > m$ and $n \geq m$. The method is then applied to a most common model of faults in programmable logic arrays: "surplus transistor", and "missing transistor". Another aspect of the problem is to devise a programmable logic array so that it will require a diagnostic enumerating matrix of minimum size. The author thanks L. Ya. Rozenblyum for discussion and useful comments. Figures 3, tables 2, references 5: 2 Russian, 3 Western.
[187-2415]

ACCOUNTING FOR ERROR STOCHASTICITY IN TERMINAL HOMING OF AIRCRAFT

Moscow IZVESTIYA AKADEMII NAUK SSSR: TEKHNICHESKAYA KIBERNETIKA in Russian No 1, Jan-Feb 84 (manuscript received 18 Jun 81) pp 213-216

KUZNETSOV, P. I., PCELINTSEV, L. A. and SABYNIN, Ye. S., Moscow

[Abstract] The energy-efficient terminal homing of an aircraft is improved by correcting for the instantaneous missed-hit error while accounting for the stochasticity of the latter. The problem of such a corrective control is formulated on the basis of a diffusion process as its model. The optimum strategy is defined in terms of the homing cost function and the Boltz criterion. The corresponding generalized Stefan boundary-value problem with indeterminate boundary is solved by uniquely satisfying the Bellman equation. The condition of "smooth splicing" is established, which yields the necessary unique set of prolongations of autonomous flight. Prolongation may be based, typically, on the fuel reserve. Solution of the Bellman equation for this problem can be facilitated by the method of backward induction in time. Flight control curves have been plotted and the payoff of corrective action based on error stochasticity has been evaluated for various typical sets of parameter values. Figures 3, references: 12 Russian. [187-2415]

PROBLEMS IN IMPROVING TRAINING OF SPECIALISTS IN ELECTRIC DRIVES

Novocherkassk IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: ELEKTROMEKHANIKA in Russian No 2, Feb 84 pp 5-10

KLYUCHEV, VLADIMIR IVANOVICH, doctor of technical sciences, professor, Moscow Institute of Power Engineering

[Abstract] The problem of rationally organizing the study course 0628 "Electric Drives and Automation of Industrial Plants" and timing it with scientific-technical developments, for improved training of engineers and other technical personnel in accordance with the guidelines set at the June 1983 plenary session of the CPSU Central Committee, is a very complex problem. The plan developed by the Commission on Scientific Method at the USSR Ministry of Higher Education provides for a syllabus which incorporates subjects in related fields such as electric apparatus design, semiconductor electronics, microelectronics, control systems, and computer methods. Training in all subjects includes theoretical study and laboratory work. Rational implementation of this plan will ensure proper sequencing of subjects and adequate continuity in the study of each discipline. The result should be acquisition of a broad profile by the generalist and of a thorough knowledge by the specialist. Typical subjects covered in eight semesters are "Computer Programming and Application", "Theory of Automatic Control with Analog Computer", "Modeling and Microprocessor Control of Electric Drives" taken in 180 class

hours and 104 laboratory hours. Subject complexity and students' material absorbing capability are taken into account. Such a course is already being taught at the Moscow Institute of Power Engineering, the Odessa Polytechnic Institute, the Leningrad Polytechnic Institute and the Leningrad Institute of Electrical Engineering. Laboratories of several All-Union Design Institutes are participating in the program.
[189-2415]

UDC 681.513.52

SYNTHESIS OF REGULATORS QUASI-OPTIMUM WITH RESPECT TO RESPONSE SPEED FOR STANDARD INDUSTRIAL OBJECTS WITH TIME LAG

Novocherkassk IZVESTIYA VYSSHIKH UCHEBNIKH ZAVEDENIY: ELEKTROMEKHANIKA in Russian No 2, Feb 84 (manuscript received 27 Jan 83) pp 52-57

KARPOV, VYACHESLAV SERGEYEVICH, candidate of technical sciences, assistant professor, and PANARIN, VLADIMIR MIKHAYLOVICH, graduate student, Tula Polytechnic Institute

[Abstract] A method of synthesizing regulators, quasi-optimum with respect to response speed, is proposed which makes such regulators applicable to some class of industrial objects describable by equations of one order. First the optimum regulator is synthesized for a linear object describable by the differential equation $\dot{X} = AX + BU(t - \tau)$ (time $\tau \leq t < \infty$) with an n -dimensional state vector X , and m -dimensional control vector $U(t) = \phi(t)$, and a constant time lag τ . The control vector is constrained by the condition that $|U| \leq 1$ and $\phi(t)$ is an m -dimensional vector of initial functions of control coordinates. The two matrices A ($n \times n$) with eigenvalues λ_k and B ($n \times m$) are constant. A state vector $h(t) = X(t + \tau)$ and then another state vector $V = Th$ are introduced, with a transformation matrix T of state coordinates. The procedure is applied to regulators for objects describable directly or after approximation by any one of the second-order differential equations $\ddot{x} + a_1 \dot{x} + a_0 x = bu(t - \tau)$, $\ddot{x} + a_1 \dot{x} = bu(t - \tau)$, $\dot{x} = bu(t - \tau)$. Depending on elements of the transformation matrix, in this case

$T = \begin{pmatrix} 1 & \tau \\ -\frac{2}{3}(\lambda_1 + \lambda_2) & 1 \end{pmatrix}$, the control $U(t) = \text{sign} \left\{ v_1 + \frac{1}{2} \alpha v_2 \mid v_2 \right\}$ is exactly

optimum when $\lambda_1 = \lambda_2$ or $\lambda_1 = 2\lambda_2$ and suboptimum otherwise. A suboptimum regulator for such objects is synthesized accordingly. An analysis of transient processes corresponding to the initial condition $\phi(t - \tau) = 0$ reveals how the amplitude of oscillations is minimized by second-order approximation of this function and compensation of the time lag. Figures 2, tables 1, references 3: 1 Russian, 2 Western.
[189-2415]

UDC 396.9:621.391

METHODS OF ESTIMATING NUMBER OF OBJECTS AND THEIR PARAMETERS FROM MEASUREMENTS OF RADIO ENGINEERING SYSTEM APPARATUS

Moscow RADIOTEKHNIKA in Russian No 2, Feb 84 pp 32-34

[Annotation of article deposited at Central Scientific Technical Institute "'Informsvyaz'", No 298]

KATULEV, A. N. and BOGDANCHUK, V. Z.

[Abstract] A systematic mathematical approach is taken to the problem of determining the contents of a radio engineering system from the vector of mutually independent output readings. The number of objects or classes of apparatus in the system, the parameters of each class, the probability of each class being measured, and the correlational error matrices are assumed to be the sought unknown quantities. The problem is solved on the basis of the appropriate minimax criterion with an upper bound and the use of likelihood functions, the power of the decision rule and the properties of estimates are established through simulation. The procedure extends to the case of adaptive sampling. References: 3 Russian.

[165-2415]

UDC 621.391

IMPROVEMENT OF RESOLVING POWER OF FREQUENCY SPECTRUM ANALYZERS

Moscow RADIOTEKHNIKA in Russian No 2, Feb 84 (manuscript received, after completion, 11 May 83) pp 46-48

ITSKOVICH, Yu. S.

[Abstract] Second-order correlational filters with weighting of signals at the output are proposed for use with parallel frequency spectrum analyzers which, during the finite duration of a signal, must not only extract the letter from an additive mixture with ambient noise and measure it but also resolve it into its various frequency components. An evaluation of the dynamic amplitude-frequency characteristic and a probabilistic estimate of

the frequency resolution reveal that side lobes can be completely suppressed without a significant narrowing of the major lobe and thus a classical correlational filter is almost attainable. Calculations demonstrating this have made for the case of only two signals with different frequencies and two corresponding exactly matched correlational filters, using the probability of resolution as a measure of the resolving power and assuming that half the sum of the two frequencies is the intermediate point at which no false detection must occur. Analytical results have been confirmed by computer-aided statistical simulation and indicate that the resolving power can not only be improved but also made noncritical with respect to the dynamic range of input signals. Figures 2, references: 6 Russian (1 item on foreign radioelectronics). [165-2415]

UDC 621.396.626

ESTIMATE OF POWER OF EQUIVALENT PULSE INTERFERENCE SIGNALS

Moscow RADIOTEKHNIKA in Russian No 2, Feb 84 (manuscript received, after 15 Apr 83) pp 65-67

KUZ'MIN, B. I. and ABRAMOVICH, A. V.

[Abstract] The power of equivalent pulse interference signals within the frequency channel of a narrow-band receiving filter is estimated analytically, such an interference signal appearing as a result of interruptions of attendant fluctuation and harmonic interference signals during suppression of the original interference by blanking. Blanking with pulses of same duration at a constant repetition rate is assumed, which in the case of sinusoidal harmonic interference results in a new interference in the form of an amplitude-keyed signal consisting of bipolar sinewave segments of equal lengths. Calculations confirm the earlier conclusion that interference blanking inevitably distorts the useful signal, the power of the resulting equivalent interference pulse signal depending on both pulse duration and pulse repetition period of the original interference. Figures 1, references: 6 Russian. [165-2415]

UDC 681.2.001.83

PRINCIPLES OF SYSTEM APPROACH TO INSTRUMENT DESIGN

Moscow PRIBORY I SISTEMY UPRAVLENIYA in Russian No 3, Mar 84 pp 15-17

AFANAS'YEV, V. N., doctor of technical sciences, and SHTAN', A. S.

[Abstract] The basic concepts of a state-wide system of industrial instruments and means of automation follow from three important principles recommended by modern system engineering. These principles are optimization of the "system"

content, optimization of the interrelation between "system" objects, and matching the "system" characteristics with those of other "systems" interacting with it. The first principle is implemented in five successive stages: unification of all measuring and automation equipment for the same application into aggregates for subsequent simultaneous design of all; sequential hierarchical decomposition of the function of each equipment into logically finalized partial functions; analysis of structures and unification of all models for the same function or similar functions into functional groups; analysis of those groups from the standpoint of engineering and service requirements; design of products in each parametric series as a single base product or several ones and their modifications. The second principle involves ensuring optimum compatibility of products with respect to six criteria: information input and output; metrological characteristics, stability in service under external actions; reliability; adaptability to primary and secondary energy sources as well as power supply lines. The third principle involves ensuring optimum technical feasibility in terms of maturation and obsolescence, relative to industrial and economic forecasts, availability of professional personnel and labor, ergonomic characteristics, and implementation of new scientific and engineering solutions in the fields of physics, cybernetics, and technology. The optimality of the product lines of the instrument thus produced will be a function of time or, more precisely, of progress in the state of the art. Introduction of microprocessors is an outstanding example of how these principles are applied in practice. Tables 1, references 16: 15 Russian, 1 Western (in Russian translation).
[191-2415]

UDC 53.089.6:681.2.001

BASIC PRINCIPLES OF CALIBRATING AND CHECKING TRANSDUCERS OF TECHNOLOGICAL
PROCESS PARAMETERS BY SIMULATION METHOD

Moscow PRIBORY I SISTEMY UPRAVLENIYA in Russian No 3, Mar 84 pp 17-19

IORDAN, G. G., doctor of technical sciences, VEL'T, I. D., candidate of technical sciences, ZHOLKOV, Yu. A., candidate of technical sciences, and KURNOSOV, N. M., candidate of technical sciences

[Abstract] The simulation method is an answer to cost effective expansion and development of instrument calibrating and checking facilities. Its gist is to act on a primary instrument transducer with a special model of a medium rather than with the real medium and to reproduce actual measurements with sufficient accuracy. At the Scientific Research Institute of Heat Power Measuring Instruments Design in Moscow this method has been applied to certification of flow meters and level gauges. A transducer is regarded as a sequence of converters, from the input quantity through intermediate quantities to the output quantity. Each component is described by a transfer function in the form of operators characterizing its static and dynamic performance. On the basis of such a mathematical model, an equivalent one is synthesized which will describe the transducer performance in a simulated medium or process. An inductive simulation test stand for calibrating and checking liquid-metal flow

meters includes a special pancake coil which senses a magnetic field and an instrument transducer which converts that magnetic field reading to a voltage equal to the voltage induced between the electrodes of a flow meter. This voltage is then divided into voltages corresponding to scale divisions below full deflection. A capacitive simulation test stand for calibrating and checking dielectric-liquid includes a variable capacitor which can be set so as to ensure reproducibility of responses to liquid levels. Both simulation test facilities have been proved out experimentally at the Scientific-Research Institute of Thermal Power Engineering Instrument Making (NIIteplopribor) in Moscow and at the Kazan branch of the All-Union Scientific-Research Institute of Physicotechnical and Radiotechnical Measurements (VNIIFTRI). Figures 2, references 12: 10 Russian, 2 Western.
[1 91-2415]

UDC 620.178.5

EGV-SERIES ELECTROHYDRAULIC VIBRATION TEST STANDS

Moscow PRIBORY I SISTEMY UPRAVLENIYA in Russian No 3, Mar 84 pp 29-31

ROZHENTSEV, V. S., candidate of technical sciences, BOCHARNIKOV, V. V., engineer, MARAKHOVSKIY, V. I., engineer, and BOTSMAN, S. G., engineer

[Abstract] The now available series of electrohydraulic vibration test stands (EGV) combines a wide performance range, from centihertz to hectahertz vibration and shaking frequencies at accelerations up to 10 g, with low cost and small size of equipment capable of accurately testing large objects under a fluid pressure up to 200 kgf/cm² under conditions closely approximating the natural environment. Large forces and displacements are produced without magnets and undesirable stray magnetic fields. The typical representative of this series, the medium-size EGV-10-100 (maximum loading force 10 tons for objects weighing up to 1000 kg, frequency range 0.05-100 Hz), had been developed at the Special Design Office for Testing Machines (SKBIM) in Armavir. It includes an exciter in the form of a double-action hydraulic cylinder with plunger on a table, rotatable through a 90° angle for either horizontal or vertical vibrations, a pump set, a storage battery, a control module, a magnetograph with function generator for setting the vibration mode and its parameters, and a loop oscillograph for recording them. The controls include a hydraulic system with a gate valve and amplifier and an electric system with feedback and automatic regulation through transducer, amplifier, detector, filter, and summator. The mismatch signal is amplified and added to the reference signal. The measuring channel contains a pickup, an amplifier, a set of filters, another amplifier, a separator of static and dynamic signals, an rms-value converter, and a cathode-ray oscilloscope for monitoring the feedback signals. Tables 1, figures 2, references: 4 Russian.
[191-2415]

CAPACITIVE DISPLACEMENT TRANSDUCER

Moscow PRIBORY I SISTEMY UPRAVLENIYA in Russian No 3, Mar 84 p 31

SELIN, V. V., engineer

[Abstract] A capacitive displacement transducer has been developed and introduced in which the main deficiency of such devices, namely nonlinearity of the conversion characteristic caused by edge effects, is minimized through stabilization of the electric field distribution while the inner electrode moves relative to the two outer stationary ones. This is achieved by means of a pair of protective electrodes inside which are mechanically coupled to the moving electrode on opposite ends of the latter and electrically connected, through sliding contacts, each to the corresponding stationary outer electrode. This eliminates the need for intricate test-signal circuitry and widens the linear range of the conversion characteristic of the order of twofold.

Figures 2, references: 4 Russian.

[191-2415]

SEMICONDUCTOR-TYPE TRANSDUCER WITH UNIVERSAL STRAIN GAUGE FOR MEASUREMENT OF LOW PRESSURES

Moscow PRIBORY I SISTEMY UPRAVLENIYA in Russian No 3, Mar 84 pp 31-32

ZAGANYACH, Yu. I., candidate of technical sciences, MAR'YAMOVA, I. I., candidate of technical sciences, IVASHCHUK, T. M., eningeer, KUTRAKOV, A. P., engineer, and POLISHCHUK, O. A., engineer

[Abstract] A pressure transducer with universal strain gauge has been developed and introduced which is adaptable to various pressure ranges by change of membrane size. The flat membrane is welded to the cylindrical housing and coupled to the strain gauge through a plunger. The strain gauge is a small cantilever rod of uniform cross section carrying a ring with lead wires and a set of tensoresistors. Deflections of the membrane by the plunger are transmitted to that strain gauge, nonlinearity of the transducer output characteristic being minimized and its dynamic range being widened by having the plunger rigidly joined to the membrane and to the rod. The membrane is made of 36NKhTYu dispersion-hardened alloy. The transducer housing and the strain gauge rod are made of the same material, the choice of material depending on the operating temperature range: 29NK Covar for -60 to $+350^{\circ}\text{C}$ or 36N Invar for -196 to $+60^{\circ}\text{C}$. The tensoresistors are 1.6 mm wide and 20-30 μm thick silicon needle crystals. All welded joints in assembly are made with a laser beam. There are two structural variants of this transducer available, plain 10 mm high and flat 3.5 mm high, both 10 mm in diameter. A membrane 0.9 mm thick and 9 mm in diameter is suitable for pressure ranges $0-10^5$ Pa and $0-2.5 \cdot 10^5$ Pa. Figures 2, tables 1, references: 4 Russian.

[191-2415]

MICROPROCESSOR-TYPE ANALYZER OF RANDOM PROCESSES

Moscow PRIBORY I SISTEMY UPRAVLENIYA in Russian No 3, Mar 84 p 34

TURGIYEV, E. A., candidate of technical sciences, VIGDOROV, D. I., candidate of technical sciences, SHEYTMAN, Ya. L., candidate of technical sciences, IZMAYLOVA, L. Z., candidate of technical sciences, ABDULLAYEV, N. T., candidate of technical sciences, ISMAYLOV, B. I., engineer, MYAKOCHIN, A. S., engineer, and GERZHOY, V. S., engineer

[Abstract] An analyzer of random processes has been developed at the Azerbaijan Petrochemical Institute imeni M. Azizbekov in Baku for analysis of bivariate stationary ergodic random processes, determination and visualization of one-dimensional and two-dimensional differential distributions of two random processes as well as their correlation, and in addition for determining mathematical expectations, dispersions, zeros, extrema, and other parameters of such processes. The analyzer contains two analog-to-digital converters which convert random input signals to 12-digit codes, a microprocessor, a read-only memory, a main memory, and a decoder, all between an address busbar and a data busbar, the latter interfaced to a generator-shaper of standard television signals with chopper, a control module, to a graphic display with screen buffer memory and record/readout memory control, symbol generator, cursor with shaper, summator, and modulator, and to an analog register. This analyzer with microprocessor can be programmed and reprogrammed for a wide range of applications. Figures 2, tables 1, references: 2 Russian. [191-2415]

UDC 538.8

NEW METHOD OF PRODUCING MEMBRANE-TYPE LIGHT MODULATOR

Moscow PRIBORY I SISTEMY UPRAVLENIYA in Russian No 3, Mar 84 p 37

KIRYUSHCHEV, I. V., engineer

[Abstract] In the otherwise conventional technology of producing a membrane-type light modulator, spreading the film membrane above the control electrodes so that it will remain perfectly plane and not imitate the substrate relief is very difficult. The RCA method of filling the recesses in the substrate for electrodes with photoresist and dissolving the latter after the membrane has been laid over is very laborious. A simpler method is proposed, instead, which involves pouring a liquid colloid (colloxylin solution in an ethanol and ether mixture) onto an intermediate substrate and then drying the latter. The substrate with dry film is immersed in water, where the colloid peels off and floats up. A modulator blank, silicon substrate, with anisotropically etched recesses for the electrode array is inserted between the intermediate substrate and the film. The entire structure is removed from the water and

dried, the film then bonded to the modulator surface while being stretched over the recesses by shrinkage. Residual water, permeable through the film, is vaporized so that a tight plane membrane results, ready for subsequent metallization under vacuum. Recesses in the silicon substrate can also be formed photolithographically with polyimide (grade PAK-1 having excellent mechanical and dielectric characteristics) as filler material. Figures 1, references 2: 1 Russian, 1 Western.
[191-2415]

UDC 621.983:65.011.56

AUTOMATIC EQUIPMENT SET FOR PRODUCTION OF CONTACTS

Moscow PRIBORY I SISTEMY UPRAVLENIYA in Russian No 3, Mar 84 pp 38-39

LYAPUNOV, S. I., engineer

[Abstract] An automatic equipment set ONp has been developed at the Special Design and Technological Office for Production Automation (SKTB AP) in Gomel which produces small flat parts, specifically contacts for sockets. It constitutes an automatic assembly line of a stamping station and a corrective-payout station with appropriate controls. Contacts are made from square bronze wire which is partly flattened in the first position, slotted in the second position, and fully bent around before being cut off in the third position. The last operation is most critical and intricate, involving also simultaneous tapering of the flat portion and rounding of the square portion. The operation is performed by three punches (upper, lower, lateral) with the blank held by a 3-step retainer in the stationary die. Complete forming is done in seven successive passes while wire is fed into the stamping press. The equipment can handle $0.6 \times 0.6 \text{ mm}^2$ wire and produce 60 pcs/min with up to 47 mm of wire length fed in one cycle. The equipment can be switched to manual operation. It draws a power of 3.5 kW and weighs 1800 kg. Figures 3, tables 1.
[191-2415]

UDC 621.9.077

GRIPPING DEVICES FOR PMR-SERIES MINIROBOTS

Moscow PRIBORY I SISTEMY UPRAVLENIYA in Russian No 3, Mar 84 p 39

LETSIK, V. I., candidate of technical sciences

[Abstract] The first series of four gripping devices developed at the Krasnodar Territorial Robotization Center for PMR minirobots with MPSh8-150 automatic manipulators in KORSH-1 and KORSH-2 stamping plants is now in production. They operate according to TU 25-10(142.199)-82 technical specifications, reliably, with compressed air (0.35 MPa) and vacuum (0.05 MPa). Each of them comes complete with suction cups, bells, collars, rollers, gaskets and shafts. Figures 1, tables 1.
[191-2415]

CHANGE IN ELECTROPHYSICAL PROPERTIES OF MOS-STRUCTURES DURING PLASMOCHEMICAL REMOVAL OF PHOTORESIST

Moscow PRIBORY I SISTEMY UPRAVLENIYA in Russian No 3, Mar 84 pp 40-41

MAROV, N. N., candidate of technical sciences, PANOVA, Z. V., candidate of technical sciences, REZANOVA, O. I., candidate of chemical sciences, GOLOSOV, V. V., candidate of chemical sciences, TREPALINA, V. I., engineer, and VAVRZHINA, S. V., engineer

[Abstract] A study of MOS structures was made for the purpose of determining the detrimental effect of photoresist removal by plasmochemical treatment, a critical process in the technology of high-threshold p-MOS devices. Examination of the SiO_2 film under a scanning raster electron-microscope revealed disappearance of the heterocontrast at a certain potential, indicating electro-physical nonhomogeneity with attendant charge leakage and potential barrier. Capacitance-voltage curves plotted during heat treatment (200°C) in an electric field ($+10^5$ V/cm) for 15 min and then at liquid-nitrogen temperature revealed a destabilizing effect of such a heat treatment on the properties of MOS structures. Electron-microscope examination and Auger spectroscopy of Si/SiO₂, Si/SiO₂/(phosphorosilicate glass), and Si/SiO₂/(phosphorosilicate glass)/Al structures after removal of the photoresist by treatment with oxygen plasma for 5 min revealed a large number of uniformly distributed "electro-physical inhomogeneities" at various levels of positive potential (typically +15 and +24 V), subsequent treatment with argon plasma for 3 min tending to reduce their number and to stabilize the properties but also to destabilize the reduced charge. Tables 1, references 4: 4 Russian, 1 Western (in Russian translation).
[191-2415]

SUPERCONDUCTING MAGNET FOR PROBING EDDY CURRENTS IN DYNAMIC MODELS

Novocherkassk IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: ELEKTROMEKHANIKA in Russian No 2, Feb 84 (manuscript received 2 Jun 82) pp 92-94

GORSKIY, OLEG IONOVICH, junior research worker, DZENZERSKIY, VIKTOR ALEKSANDROVICH, candidate of physico-mathematical sciences, chief of laboratory, and VOROVSKIY, VALERIY YUREVICH, engineer, Institute of Engineering Mechanics, UkSSR Academy of Sciences

[Abstract] A superconducting magnet has been built for probing the electromagnetic interaction of strong magnetic fields and moving current conductors. Its main feature is a successful solution to the complex problem of force transmission from the induced magnetic field and the secondary magnetic field in a conductor to the surrounding cryostat walls. Stability of its operation without extra coolant flow is ensured by adequate thermal insulation and adequate magnetic field strength. The magnet also has a relatively small mass, operates completely reliably and safely, is vibration- and shake-proof. Its coolant requirement in the "frozen field" mode of operation does not exceed 1.4 l/h. The magnet coil is immersed in helium inside a $0.6 \times 0.45 \times 0.35$ m³ cryostat, an indium insert providing a seal which is effective at temperatures down to 4.2 K. The magnet has been designed for tangential and normal forces which correspond to an infinitely thick and long current-carrying moving aluminum bar, with a proper correction factor accounting for nonideality of the conductor in the form of finite thickness. The magnet can also be used for suspension of vehicles in high-speed ground transportation systems. Figures 2, references 4: 2 Russian, 2 Western (1 in Russian translation). [189-2415]

OPTIMUM DIMENSIONS OF POWER SOLENOIDS FOR MAGNETIC SUSPENSION

Novocherkassk IZVESTIYA VYSSHIKH UCHEBNIKH ZAVEDENIY: ELEKTROMEKHANIKA in Russian No 2, Feb 84 (manuscript received 29 Jan 82, after completion 12 Oct 82) pp 94-96

KAZNACHEYEV, BORIS ALEKSANDROVICH, candidate of technical sciences, assistant professor, Leningrad Institute of Mechanics

[Abstract] Design optimization of power solenoids for controllable and stabilizable magnetic suspensions with force compensation in a wind tunnel is shown, assuming that the model of a levitating body is a sphere of ferromagnetic material with constant magnetic permeability. This sphere, with a radius much smaller than its distance from the solenoid above, is to be maintained in position on the solenoid axis by balance of the vertical electromagnetic force and the force of gravitation. The necessary vertical (axial) force generated by the solenoid is expressed as a function of relevant system dimensions, solenoid design parameters, and physical properties of the body. On the basis of this relation and the relation for solenoid power three families of curves are obtained which depict the solenoid power for a given force as a function of the solenoid length with either outside radius or inside radius as a variable parameter and as a function of the outside radius with inside radius as a variable parameter. These curves indicate the optimum solenoid length and outside radius, for minimum power, corresponding to a given outside radius and inside radius, respectively. Figures 4, references 4: 3 Russian, 1 Western (in Russian translation).
[189-2415]

UDC 621.311.25:621.039]:699.841

NECESSITY OF CONDUCTING IN SITU TESTS ON RESISTANCE TO SEISMIC IMPACT OF ELECTRICAL EQUIPMENT INSTALLED IN NUCLEAR POWER PLANTS

Moscow ELEKTRICHESKIYE STANTSII in Russian No 1, Jan 84 pp 2-4

KIRILLOV, A. P., LUKIN, V. V., doctors of technical sciences, PISKAREV, V. V., candidate of technical sciences, Scientific Research section of "Gidroproyekt" A-U Research Institute imeni S. Ya. Zhuk

[Abstract] A method for determining functional capacity and performance of electrical equipment used with nuclear power plants under seismic disturbance conditions was developed by the "Gidroproyekt" research section. This involves subjecting the equipment to a harmonic stress simulating a seismic impact equivalent to a maximum rated earthquake of force 9. Laboratory testing of some representative electrical units was conducted. Structures of identical type exposed to the same dynamic stress under identical conditions demonstrated a considerable spread of dynamic characteristics. These tests help to reveal malfunctions and to develop seismic protection measures for the mass-produced equipment. On-site testing of the equipment also revealed a considerable spread in dynamic characteristics of identical units. The conducted studies demonstrate the necessity of in situ testing of critical electrical equipment for nuclear power plants for its ability to withstand earthquakes. These studies indicate that by applying developed methods and test instruments, an accurate evaluation can be made of electrical equipment resistance to seismic impact. Figures 3, tables 1, references: 4 Russian.

[119]

UDC 621.311.016.4.088

INACCURACIES IN ACCOUNTING FOR ELECTRICAL POWER LOSSES

Moscow ELEKTRICHESKIYE STANTSII in Russian No 1, Jan 84 pp 44-46

ZHELEZKO, Yu. S., candidate of technical sciences, All-Union Scientific Research Institute of Electrical Power Engineering

[Abstract] Methods for computing electrical power losses in networks accounting for inaccuracies of measurements and lack of the necessary information on circuits and loads allow to compute the upper boundary of possible losses due

to technical causes $\Delta W_{t. \max}$. The commercial losses in this case will be not less than

$$\Delta W_{\text{com. min}} = \Delta W_{\text{acc}} - \Delta W_{t. \max}$$

where ΔW_{acc} are the accountable losses. Measures must be initiated for reducing the commercial losses if $\Delta W_{\text{com. min}}$ is greater than the admissible value of discrepancy of meter readings due to normalized errors in the line elements. When determining the admissible errors in computing the actual consumption of electrical energy, the reading inaccuracies of the instrument transformers, total error in the line, different power carrying capacity at various points, systematic component of error due to voltage drop in the voltage transformer circuits must be accounted. The equations provided with the text allow determining the range of the admissible errors in the individual measuring lines, range of the admissible power discrepancies of some substations and the values of acceptable commercial energy losses for the entire power system, factory power stations or the district power stations.

Computation examples and tables for various classes of accuracy are included. Tables 3, references: 3 Russian.

[119]

UDC 621.311.018.41.016.2.078

DIGITAL SYSTEM FOR AUTOMATIC CONTROL OF FREQUENCY AND ACTIVE POWER IN SIBERIAN POWER POOL

Moscow ELEKTRICHESKIYE STANTSII in Russian No 1, Jan 84 pp 49-52

VENEVITSEV, Yu. S., GVOADEV, B. I., NESTERENKO, V. L., engineers, and YAKOVLEVA, T. S., candidate of technical sciences, Power Network Project--ODU [United Dispatcher Control] Siberian VNIIE [All-Union Scientific-Research Electrical Energy Institute]

[Abstract] This paper considers the problems of an analog system of automated control of frequency and power developed by the All-Union State Planning, Surveying and Scientific-Research Institute of Power Systems and Electric Power Networks (Energoset'proyekt), and used for more than 10 years in the Siberian United Power (OES) system for fulfillment of the problem of automatic control of frequency and power. The technological principles of construction of a digital system of automatic control of frequency and power (TsSARChM), the structure of programs and hardware components of the information-control complex, and control complex and security reliability are examined. It is concluded that the operating characteristics of the complex confirm the possibility of alignment of information and controlling problems in case of them having a sufficiently large extent. Practical results confirm the possibility of obtaining a level of reliability of a two-machine complex without the use of a parallel account on the basis of mutual monitoring and reservation of an electronic computer. Figures 2, references: 3 Russian. [119-6415]

PB 750-3 REINFORCED CONCRETE SUPPORT OF VL 750 kV CHERNOBYL'SKIY ATOMIC ENERGY PLANT--VINNITSA POWER LINE

Moscow ELEKTRICHESKIYE STANTSII in Russian No 1, Jan 84 pp 62-65

KURNOSOV, A. I., candidate of technical sciences, NAKONECHNYI, Ya. A., and GAL'PERIN, B. M., engineer, All-Union State Planning, Surveying and Scientific-Research Institute of Power Systems and Electric Power Networks [Energoset'proyekt]. Northwest Department--of Southwest Power Line System

[Abstract] The paper is concerned with one of the features of the VL 750 kV Chernobyl'skiy Atomic Energy Plant--Vinnitsa Power Line which began operation on 10 September 1982. The first in world practice intermediate reinforced concrete supports, the PB 750-3 with a height of 32 meters, are established in one of the anchoring sections of this line, instead of a metallic P 750 with guys foreseen in the project. It is concluded that: 1) Construction of the PB 750-3 intermediate reinforced concrete supports satisfies all the requirements imposed on supports for this voltage, 2) For a decrease of labor expenditures and reduction of the time for erection of supports, cranes with certain characteristics are necessary; 3) For an increase of the production of plants for producing reinforced concrete supports, reduction of labor expenditures, as well as a decrease of waste during production, it is advisable to organize production of cast flange construction instead of the welded adopted in the present project; and 4) Use of PB 750-3 supports assures saving of steel, capital and labor expenditures and, consequently, a higher rate of erection. The areas of occupied ground are markedly reduced.

Figures 4.

[119-6415]

UDC 511.118

ANALYSIS AND SYNTHESIS OF COMBINED DIGITAL AND ANALOG SPEED REGULATION

Novocherkassk IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: ELEKTROMEKHANIKA in Russian No 2, Feb 84 pp 45-51

KOTSEGUB, PAVEL KHARITONOVICH, candidate of technical sciences, assistant professor, TOLOCHKO, OL'GA IVANOVNA, candidate of technical sciences, instructor, and GUBAR', YURIY VLADIMIROVICH, graduate student, Donetsk Polytechnic Institute

[Abstract] Combined digital and analog speed regulation of electric motors during starting and braking is considered, these modes of operation being limited by acceleration or deceleration as well as by the speed requirements. The structure of such a system of implementing regulation according to a given law of speed variation consists of an analog proportional speed regulator with a subordinate current regulator and a subordinate digital speed regulator,

the latter coupled to the analog regulator through a decoder which also serves as zeroth-order extrapolator. Speed is measured by an analog tachometer generator and a digital tachometer operating with a pulse transducer mounted on the motor shaft. The given law of speed variation is established by a digital rate setter. The regulation algorithm is constructed analytically and the transient processes are simulated on a digital computer, for subsequent synthesis of such a regulation system. Figures 4, references: 7 Russian.
[189-2415]

UDC 621.372.832.6

COPHASAL AND ANTIPHASAL BALANCED POWER DIVIDERS

Moscow RADIOTEKHNIKA in Russian No 2, Feb 84 (manuscript received, after condensation, 11 Jun 83) pp 67-70

BAL'SEVICH, A. S. and GVOZDEV, V. I.

[Abstract] General relations for the performance characteristics of integrated-circuit balanced microwave power dividers are applied to two topological variants of a planar ring structure, unilateral and bilateral on the substrate, each variant with four different combinations and configurations of symmetric and asymmetric strip lines, symmetric and asymmetric slot lines, and coplanar lines correspondingly most expedient for four possible electrical circuit connections: two cophasal ones and two antiphasal ones. The power quotient and the decoupling factor as well as their frequency dependence and the conditions for matching are determined from the coefficients of the scattering matrix and the wave impedances of transmission line segments, assuming the latter to be lossless. Calculations are based on the equivalent circuit, series or parallel. For minimum power loss, the output arms are connected either near the input arm or near the balancing resistor. Figures 3, references: 5 Russian.
[165-2415]

UDC 621.319.92:621.315.1

CONCERNING POSSIBILITY OF INCREASING COVERAGE OF DIFFERENTIAL-PHASE PROTECTION OF ELECTRICAL TRANSMISSION LINES

Minsk IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: ENERGETIKA in Russian No 4, Apr 84 (manuscript received 29 Oct 82) pp 3-8

LYSENKO, G. I., candidate of technical sciences, Siberian Scientific-Research Power Institute

[Abstract] High-frequency differential-phase current protection (DFP) operates effectively on lines, the length of which does not exceed 350-400 km. With

use of DFP on lines longer than 400 km their operation is hindered for a number of reasons, the most important of which are listed in this paper. It is shown, however, that in DFP of electrical transmission lines, as a controlled parameter $\dot{V} = (\dot{U}_\alpha + Z_c \dot{I}_\alpha) + K(\dot{U}_\beta + Z_c \dot{I}_\beta)$ makes it possible to construct discriminating protection of lines with a length up to 1,000-1,100 km with an identical (inductive) nature of the equivalent resistances of adjoining systems for faults in coverage of protection, and lines with a minimum length on the order of 400 km with a different (inductive and capacitance) nature of the equivalent resistances. In accordance with the results of an analysis, the range of values of the coefficient K , determined from the condition of a sufficient sensitivity of protection to all forms of damage, are found in the limits $(1.1 \pm 1.2) \exp. (-j \frac{\pi}{2})$. Figures 3, references: 3 Russian.
[203-6415]

UDC 621.374.22

SYNTHESIS OF SHAPING FOUR-TERMINAL NETWORKS WITH INDUCTIVE-CAPACITIVE STORAGE OF ENERGY

Minsk IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: ENERGETIKA in Russian No 4, Apr 84 (manuscript received 7 Apr 83) pp 28-32

VITSINSKIY, S. A., engineer

[Abstract] This paper resolves the problem of synthesis of four-terminal networks with inductive-capacitance storage of energy. Realization here of such four-terminal networks, as well as in a 1982 paper also by Vitsinskiy, assumes two-sided switching. However, these circuits differ by the nature of switching (one of the switches operates on closing and the other on opening) and, as a consequence, the form of the influencing functions and the possibilities of shaping with respect to a class of time functions. The method presented for synthesis of four-terminal networks can be used for the design of various pulse circuits, in particular during planning of power supply sources for lasers. The paper was presented by the Department Faculty IPEFY [expansion unknown]. Figures 3, references: 3 Russian.
[203-6415]

UDC 681.325.65

CONSTRUCTION OF CHECK TESTS FOR LOGIC UNITS WITH STORAGE

Minsk IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: ENERGETIKA in Russian No 4, Apr 84 (manuscript received 28 Mar 83) pp 32-35

POLYAKOV, V. Ye., doctor of technical sciences, and SOLOV'YEV, L. N., engineer, Ural Order of Labor Red Banner Polytechnical Institute imeni S. M. Kirov, Relay Construction VNIPKTI [expansion unknown]

[Abstract] A method of constructing check tests for combination circuits, presented in a 1981 paper by the authors [Method Of Construction Of Check Tests

For Combination Logical Circuits Based On Integrated Microcircuits], can also be used for logic units containing storage elements. The sequence of checking and the formulation of the check test of the circuit are performed, taking account of the special features of operation of the storage elements. The process of constructing check sets for logic units with storage by the proposed procedure is sufficiently simply formalized and can be automated. Figures 3, tables 2, references: 4 Russian.
[203-6415]

UDC 621.3.015:621.316.176:622.271.4

VOLTAGE CONDITIONS IN LINE FEEDING A LARGE EXCAVATOR

Minsk IZVESTIYA VYSSHIKH UCHEBNIKH ZAVEDENIY: ENERGETIKA in Russian No 4, Apr 84 (manuscript received 3 Mar 83) pp 46-49

KOTLYARCHUK, V. A., candidate of technical sciences, docent, Krasnoyarsk Order of Labor Red Banner Institute of Nonferrous Metals imeni M. I. Kalinin

[Abstract] On the basis of information concerned with the electrical operating conditions and electrical supply of a large excavator, evaluations are made of the effect of duty of the excavator on the voltage drop in the feed line. The dynamicness of the processes, the block diagram of the electrical supply of large excavators, the overexcitation of synchronous motors and their operation in a regime of regeneration, exert a noticeable influence on the condition of the feed line voltage. The paper was presented by the Department Faculty for Electrification of Mining-Metallurgical Production. Figures 1, tables 1, references: 3 Russian.
[203-6415]

UDC 621.314.21.042.53-181.4

CONCERNING OPTIMUM GEOMETRY OF SHELL-TYPE TRANSFORMERS WITH ALUMINUM AND COPPER WINDINGS

Minsk IZVESTIYA VYSSHIKH UCHEBNIKH ZAVEDENIY: ENERGETIKA in Russian No 4, Apr 84 (manuscript received 24 May 83) pp 54-56

ARTISHEVSKIY, V. A., candidate of technical sciences, assistant professor, Belorussian Order of Labor Red Banner Polytechnical Institute

[Abstract] This paper is concerned with determining the optimum geometrical dimensions of a single-phase shell-type transformer with a ribbon magnetic circuit, in accordance with the conditions of a minimum volume, minimum mass, and minimum cost, with an assigned product $S_{ok}S_{ct}$ (S_{ok} = cross section of transformer window; S_{ct} = cross section of transformer magnetic circuit). The paper was presented by the Department Faculty for Electrical Supply of Industrial Plants, Cities, and Agriculture. References: 4 Russian.
[203-6415]

UDC 535.41:621.372.2

INSPECTION OF OUTSIDE DIAMETER OF OPTICAL FIBERS BY COMPARISON OF DIFFRACTION PATTERNS

Moscow RADIOTEKHNIKA in Russian No 2, Feb 84 (manuscript received, after completion, 19 Jul 83) pp 82-86

ZAVITNEVICH, Yu. V., KOZLOV, A. A. and MIROVITSKAYA, S. D.

[Abstract] An inspection method and necessary equipment have been developed for measuring the outside diameter of optical fibers, an important part of product quality control in the fiber extrusion process. It is a variant of the diffraction method, a comparative one, with the inspection sample and the etalon fiber oriented perpendicularly to one another. Radiation from a laser source is shaped by optics into a conically convergent beam which passes successively through the horizontal etalon fiber, transmitting optics, the vertical inspection sample, and optics which form two corresponding orthogonal diffraction patterns on a projection screen without interference and mutual shading. On the screen are mounted four photoreceivers, one at each of the four first-order minima in the diffraction cross. The screen is located at a distance ensuring maximum resolution of first-order diffraction minima for both fibers. The accuracy of diameter measurement depends on the precision of the etalon fiber and on the accuracy of measurement of distances between zeros in the diffraction pattern of the inspection sample, taking into account the "tolerance fields" of both fibers. Experimental diameter measurements were made with this equipment on six batches of fibers, their diameters also having been checked under an MBI-9 microscope with $\pm 0.5 \mu\text{m}$ precision. The accuracy of this diffraction method was found to be within 1% for large fibers 90-160 μm in diameter and within 2% for small fibers 90-50 μm in diameter. Figures 4, tables 2, references 2: 1 Russian, 1 Western (in Russian translation).

[165-2415]

ANALYSIS OF FREQUENCY-SELECTIVE INTEGRATED CIRCUITS IN SYSTEM OF NORMAL COORDINATES

Moscow MIKROELEKTRONIKA in Russian Vol 12, No 6, Nov-Dec 83
(manuscript received 28 Apr 83) pp 540-547

ARUTYUNOV, P. A., Moscow Institute of Electrical Machine Building

[Abstract] The Tellezhen theory is used in an interpretation of the law of conservation of complex power. In this variation the theory is generalized for the case where the current and voltage of the branches of an integrated circuit are random functions of time. The demonstration of the theory presented is based on fulfillment of the Kirchhoff law for electronic circuits with random currents and voltages of the branches. The simple theory given of a statistical analysis of a frequency-selective integrated circuit in a system of so-called normal coordinates which have energy dimensions is a generalized method of normal oscillations for LCR circuits. As a basis is taken a general theorem as well as an orthogonal system of vectors of the modes and a system of normal coordinates of the circuit; the latter is a projection of the vectors of reaction on the vectors of normal oscillations. Use of a canonical expansion of random functions for currents and voltages considerably simplifies computation of integrated circuits. In this case, the reaction for mathematical expectations is computed at first, and later for coordinate functions with zero input and zero state of the circuit. The results obtained can be extended to circuits with controlled sources. For this, it is necessary to use the concept of a conjugate circuit and the general theory. As long as the natural frequencies (initial and conjugate) are identical, it is easy to demonstrate the orthogonality between the vectors of the modes of the given and conjugate circuits. In order to perform computations of frequency-selective integrated circuits by the method of free oscillations, it is necessary to assign the natural frequencies of the circuit, the parameters of the circuit, and the sources of excitation. References: 9 Russian.
[177-6415]

MACHINE COMPUTATION OF DELAY AND CAPACITANCE OF TRANSISTOR STRUCTURES OF
SUBNANOSECOND LARGE INTEGRATED CIRCUITS

Moscow MIKROELEKTRONIKA in Russian Vol 12, No 6, Nov-Dec 83
(manuscript received 6 Dec 82) pp 548-560

BUBENNIKOV, A. N., Moscow Physico-Technical Institute

[Abstract] This paper is concerned with identification of the delay time and capacitance of the transistor structure (TS) [total and barrier], revealing the coupling of the parameters of technology and topology with the inertial characteristics of the TS of large integrated circuits (LIC) with the aid of methods and programs of technological, physico-topological modelling and optimization within the framework of multilevel modelling of LIS. The requirements for high-quality modelling, identification and optimization of the transistor structure, linear element and fragments of LIS within the framework of a complete cycle of an automated design system (SAPR) of LIS is dependent upon a list given in the paper of the basic factors for development of an elementary base. The following items are considered in some detail: 1) Technological model of TS LIS; 2) Physico-topological model of TS LIS; 3) Computation of inertia characteristics of TS; and 4) Results of physico-topological modelling and discussion of results. Figures 6, references 21: 8 Western, 13 Russian.
[177-6415]

UDC 621.3.049.77

COMPARISON ANALYSIS OF ALGORITHM FOR CONSTRUCTION OF FUNCTIONAL TESTS FOR
COMBINED LARGE-SCALE INTEGRATED CIRCUITS

Moscow MIKROELEKTRONIKA in Russian Vol 13, No 2, Mar-Apr 84
(manuscript received 1 Mar 83) pp 107-117

ALEKSENKO, A. G., KARPOV, A. S., and ROTNOV, S. V.

[Abstract] The need to choose an effective algorithm for construction of functional tests to be used in systems of input and output monitoring of large-scale integrated circuits (BIS) and super-BIS is considered. It is concluded that the most promising algorithms for this purpose are based on the use of the apparatus of Boolean derivatives (ABD). The potential advantages of ABD are realized with the use of a highly-efficient electronic computer of a new generation, equipped with associated parallel processes. As evaluations show, for a combined BIS and super-BIS with a degree of integration larger than 10^3 - 10^5 crystal gates, the effectiveness of ABD is two to four orders above the effectiveness of the D-algorithm widely used at present. The structure and small number of relatively simple ABD modules make it possible to develop an effective and available wide circle of specialists in the construction of functional tests for combined monitoring. Figures 4, references 9: 2 Russian, 7 Western (3 in Russian translation).
[205-6415]

QUASI-THREE DIMENSIONAL MODELING OF FUNCTIONALLY-INTEGRATED ELEMENTS OF
LARGE-SCALE INTEGRATED CIRCUITS

Moscow MIKROELEKTRONIKA in Russian Vol 13, No 2, Mar-Apr 84
(manuscript received 20 Jan 83) pp 118-128

PETROSYANTS, K. O. and GUROV, A. I., Moscow Institute of Electron Machine
Construction

[Abstract] Functional integration, which is one of the principal directions for creation of highly-integrated subsystems of large-scale integrated circuits (BIS) and super-BIS, makes it possible substantially to reduce the number of metallized connections and contact areas to the individual regions of a semiconductor structure, as well as to realize the basic connections between the elements within the semiconductor volume. Planning of a functionally-integrated structure (FIS), which assures device parameters optimum for circuit-engineering applications, is unthinkable without sufficiently precise machine models, taking various items into account. Consequently, a series of models concerned with the special features of construction of FIS of various types was developed. As a result of this work a quasi-three dimensional model is presented of the functionally-integrated elements of a bipolar BIS, which are multilayer semiconductor structures with an arbitrarily arranged diffused region and metallized contacts, controlled by a current or voltage. The model is described by a system of differential equations in partial derivatives of the elliptical type with integral limitations. A numerical algorithm uses a Newtonian procedure of quasi-linearization in conjunction with a block method of upper relaxation. The model is realized in the form of a program in Fortran-IV for a unified system of electronic computers, intended for solution of a wide range of problems which originate during planning of BIS, in particular choice of the optimum versions of topology, routes, and the electrical regime of the elements. Figures 6, tables 2, references 19: 9 Russian, 10 Western.
[205-6415]

UDC 621.382.8

ANALYSIS OF DYNAMIC CHARACTERISTICS AND WAYS OF DEVELOPMENT OF BIPOLAR MAIN
MEMORY WITH MINIATURIZATION OF INTEGRATED CIRCUIT ELEMENTS

Moscow MIKROELEKTRONIKA in Russian Vol 13, No 2, Mar-Apr 84
(manuscript received 5 May 83) pp 129-137

SERGEYEV, A. G., SAVENKOV, V. N., PARMENOV, Yu. A., NEKLYUDOV, V. A. and
MINDEYEVA, A. A., Moscow Institute of Electrical Engineering

[Abstract] The paper presents a forecast estimate of the characteristics of a super-large scale integrated circuit (super-BIS) memory as applied to bipolar main memory (OZU) circuits. The conclusions drawn are probably also correct for other types of bipolar memory units. With the existing trend of technological

growth, the limiting speed of bipolar OSU with $d \lesssim 2$ micrometer will basically be determined by the characteristics of the interconnections and not by the parameters of bipolar devices. With $d \lesssim 2$ micrometer, slowing down of the rate of growth of the response speed of OZU must be expected as the result of miniaturization as a consequence of the increase of the specific capacities of the p-n junctions and the metallization and constraint on the current density in the interconnections. This limitation, together with the specific properties of the energetics of bipolar OZU--localization of the current in separate lines, leads to a variance between speed of response and the degree of integration. For realization of the potentially high speed of response of bipolar OSU an improvement is necessary of the technology of the interconnections with the object of an increase of the current density in them, and, it is possible, mastering a three-layered system of interconnections. In so doing the amount of time for information access can be reduced by 1.5--3 times. The I²L memory is promising for use in the construction of an OZU with $N \geq 16$ kilobit. With utilization of a minimum dimension less than 0.5-0.7 micrometer, it is possible that I²L elements will also be used in the control circuits of the OZU. Figures 7, references 24: 14 Russian, 10 Western. [205-6415]

UDC 621.382.8.001.2

PLANNING OF HYBRID INTEGRATED CIRCUITS FOR MICROWAVE-BAND OSCILLATORS

Moscow MIKROELEKTRONIKA in Russian Vol 13, No 2, Mar-Apr 84
(manuscript received 11 Apr 83) pp 138-147

PETROV, G. V., Moscow Engineering-Physical Institute

[Abstract] The paper presents an analytical method of calculating the hybrid integrated circuits (GIS) of microwave-band oscillators based on field-effect transistors with a Schottky gate (PTSh), using a transmission matrix of noise waves and parameters of the PTSh. (Elements of the transmission matrix are calculated on the basis of the spreading parameters, measured in a large signal operation.) The following items are considered in the paper: 1) Spreading and transmission matrices in large signal operation; 2) Noise parameters of PTSh with feedback; 3) Parameters of tuned circuit and matching network [tsep']; 4) AM and FM noise of GIS oscillators; and 5) Development of low-noise GIS oscillators. The analysis made of microwave-band GIS oscillators based on PTSh permits the conclusion that use of noise waves and noise parameters makes it possible to calculate the AM and FM noise of microwave-band GIS oscillators and to forecast their behavior for PTSh with varied feedbacks. Figures 6, references 10: 9 Russian, 1 Western. [205-6415]

PROPAGATION OF ACOUSTIC SHEAR WAVES THROUGH ACTIVE PERIODIC STRUCTURE

Moscow AKUSTICHESKIY ZHURNAL in Russian Vol 30, No 1, Jan-Feb 84
(manuscript received 28 Jun 82) pp 23-27

BULGAKOV, A. A. and TIMCHENKO, A. I., Institute of Radiophysics and Electronics,
UkSSR Academy of Sciences

[Abstract] Characteristics of transversely polarized acoustic vibrations in regular periodic piezosemiconductor structures with vacuum gaps between layers are analyzed, using the propagation of Gulayev-Bluestein surface shear waves as reference and assuming a drift of charge carriers along the semiconductor surfaces. The dispersion equation for a periodically laminate and also symmetric structure, piezosemiconductor layers of the same thickness a each and vacuum gaps of the same width b each, is derived by the method of transfer matrices. The transfer matrix for a vacuum relates the tangential electric field components and the normal electric displacement components at the gap boundaries. The transfer matrix for a piezosemiconductor layer is based on a zero normal component of acoustic pressure on both sides of the layer, with continuity of the tangential electric field component and discontinuity of the normal electric displacement component. First are considered thin layers $k_y a \ll 1$ (k_y - normal wave number in piezosemiconductor), with almost uniform distributions of the electric field and the acoustic field. Then are considered thick layers $k_x a \gg 1$ (k_x - tangential wave number), assuming a uniform low dielectric permittivity. One feature is resonance between symmetric and antisymmetric modes, which produces a suppression band characteristic of periodically laminate structures. Another feature is appearance of slot modes, but only at low charge carrier concentrations, with large velocity anisotropy and large buildup increment near resonance. Figures 3, references 14: 10 Russian, 4 Western (1 in Russian translation).
[202-2415]

THERMALLY STABLE POLYHEDRAL SOUND GUIDES MADE OF QUARTZ SINGLE CRYSTALS FOR
ULTRASONIC DELAY LINES

Moscow AKUSTICHESKIY ZHURNAL in Russian Vol 30, No 1, Jan-Feb 84
(manuscript received 20 Jul 82) pp 28-31

GOLIK, A. V., KOROLYUK, A. P. and MATSAKOV, L. Ya., Institute of Radio Physics
and Electronics, UkSSR Academy of Sciences

[Abstract] Polyhedral single crystals of such materials as quartz perform well as sound guides and ultrasonic delay lines on volume acoustic waves, but their design is difficult considering that generally the direction of energy propagation and thus of the group velocity in elastically anisotropic media does not coincide with the direction of the wave vector. An algorithm of exact design and performance calculations is proposed here which involves solving the equations of sound propagation through such media. As operating mode is selected a shear wave polarized along the X-axis (electric axis) and propagating in the YZ-plane (Y- mechanical axis, z- optical axis) in a quartz or other crystal with trigonal lattice. The wave path is determined as one with the most rational sequence of reflections by the crystal facets, taking into account the orientations of facets and establishing their necessary dimensions on this basis. An important consideration is minimizing the temperature coefficient of delay, either over a wide temperature range without a thermostat or over a narrow (0.01-0.5°C) temperature range in a thermostat. In the latter more practical case the temperature coefficient is expressed through the coefficient of linear thermal expansion and the temperature coefficient of group rather than phase velocity. Differentiation yields the minimum coefficient in terms of design parameters. In sound guides with few facets ($N < 12$) it is possible mutually to fully compensate positive and negative $\tau_i T_{\tau_i}$'s (τ_i - passage time from one facet to another, T_{τ_i} - temperature coefficient of delay in i-th passage). As the number of facets increases ($N \geq 12$), full compensation becomes unattainable and the minimum coefficient, always positive, increases while the ratio of maximum coefficient to minimum coefficient decreases regardless of the facet orientation angle. Figures 3, references 5: 3 Russian, 2 Western.
[202-2415]

UDC 621.391:535.42

EFFECT OF ACOUSTIC DAMPING ON OUTPUT SIGNAL OF ACOUSTOOPTIC FILTER FOR
COMPRESSION OF LINEARLY FREQUENCY MODULATED INPUT SIGNAL

Moscow RADIOTEKHNIKA in Russian No 2, Feb 84 (manuscript received 16 May 83)
pp 43-45

VASIL'YEV, Yu. G.

[Abstract] Damping of an acoustic wave in the sound guide of an acoustooptic light modulator is included in the performance analysis of a high-frequency

acoustooptic compression filter of linear-frequency-modulation signals. The frequency resolution is degraded by widening of the light distribution in the first diffraction order. Calculations reveal, moreover, that this damping distorts the waveform of the filter output signal and, consequently, also the envelope-squared of the autocorrelation function of the input signal. The aperture of the light modulator must, therefore, be designed depending on the acoustic damping coefficient to ensure that the maximum permissible distortion is not exceeded. Figures 3, references 6: 5 Russian, 1 Western. [165-2415]

CSO: 1860

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