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USSR AND EASTERN EUROPE SCIENTIFIC ABSTRACTS  
ELECTRONICS AND ELECTRICAL ENGINEERING  
No. 32

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19 August 1977

# USSR AND EASTERN EUROPE SCIENTIFIC ABSTRACTS

## ELECTRONICS AND ELECTRICAL ENGINEERING

No. 32

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USSR

UDC 621.375.017.8

EVALUATING NONLINEAR DISTORTION IN LOW-FREQUENCY AMPLIFIERS WITH QUANTIZATION

Moscow ELEKTROSVYAZ' in Russian No 3, Mar 77 pp 46-49 manuscript received 5 Feb 76

KIBAKIN, V. M., DOGADIN, O. V., and GIL'MAN, O. A.

[Abstract] The nonlinear distortions in push-pull amplifiers with quantization of the input signal are treated, where these distortions are caused by the nonidentity of the frequency response of the amplifier channels. To reduce the magnitude of nonlinear distortion at the upper working frequency in class B amplifiers, both those in operation and those under development, it is expedient to employ synthetic equalization of the frequency and phase characteristics of the channels amplifying the positive and negative components of the input signal. In devices with quantization of the input signal into  $n$  levels, it is necessary to equalize the frequency response of all channels for both the positive and negative components, or the characteristics of the channels for the corresponding subdivision levels of the positive and negative components of the signal being amplified. The level of these distortions are evaluated and an analytical expression for the magnitude of the nonlinear distortions of a class B amplifier is given in the form of a function of the passband of the amplification channels and the instantaneous frequency of the signal being amplified. Figures 5; references 5 (Russian).

USSR

UDC 621.375.132.9

NON CASCADE CONNECTIONS OF AMPLIFIER COMPONENTS IN AN AMPLIFIER WITH FEEDBACK

Moscow ELEKTROSVYAZ' in Russian No 3, Mar 77 pp 64-68 manuscript received 20 Sep 75

LUR'YE, B. YA.

[Abstract] A wideband amplifier with a high feedback level is provided with two parallel signal paths. Where the usual circuit design requires the use of frequency equalizers to reduce the feedback loop gain at higher frequencies, this configuration combines the best properties of the two amplification paths, and thereby achieves an increase in the transmission gain at the asymptotic high frequencies, and as a consequence, increases the permissible feedback level. The integral limitation of the resulting gain is determined, a calculation procedure is presented for the circuit, and circuit examples and experimental results are given. The circuit solutions for the different amplifier signal paths include common emitter and common collector configurations of discrete components. Figures 6; references 4 (Russian).

USSR

UDC 621.396.67.012.12

## ANALYSIS OF RADIATION PATTERNS OF A PARABOLIC HORN ANTENNA ON HARMONIC FREQUENCIES

Moscow RADIOTEKHNIKA in Russian Vol 32 No 5, May 77 pp 52-56 manuscript received 1 Dec 75

PAVLOVA, V. A., RUBINSHTEYN, G. R., and SENCHILO, A. YA.

[Abstract] The solution of problems of electromagnetic compatibility of electronic equipment requires data on the radiation patterns of antennas on harmonic frequencies. In this paper, radiation patterns are analyzed on harmonics for a parabolic horn antenna. Calculations of average radiation patterns on harmonics in accordance with proposed formulas show that regardless of the ratio between powers of higher wave modes, the directions of maximum emissions in planes E and H lie in sectors with angles relative to the antenna axis that do not exceed  $0.6-1.1^\circ$  on the first five harmonics. For a given harmonic, these angles do not exceed those that correspond to the maximum values of the directional characteristics on the main polarization of the field, which are caused by the higher modes of transmitted waves of highest order  $(m + n)$  in planes H and E respectively. The directions of maximum emissions on harmonic frequencies do not go beyond the limits of the main lobe of the radiation pattern on the fundamental wave. When the powers (dispersions) of individual modes of transmitted waves are equal, the maximum emission on harmonic frequencies is directed along the axis of the antenna (as on the fundamental frequency). A comparison of calculated and experimental data confirms the conclusions drawn in the paper and shows that the radiation patterns of parabolic horn antennas can be evaluated by using the formulas and curves given by the authors. Figures 3; tables 1; references 4 (Russian).

USSR

UDC 621.372.54

A MICROWAVE OSCILLATORY SYSTEM TUNABLE BY SEVERAL VARIABLE CAPACITORS

Kiev IZVESTIYA VUZOV: RADIOELEKTRONIKA in Russian Vol 20 No 3, Mar 77 pp 86-91 manuscript received 4 Jan 76; after revision 27 Feb 76

BOGACHEV, V. M., and LAUT, L. N.

[Abstract] A microwave oscillatory system is analyzed which constitutes an extension of a circuit with a variable series capacitance. A wider tuning range or the same tuning range under more stringent constraints is made feasible by the use of several variable capacitors. An analysis of various equivalent circuits shows that, with an increasing number of optimally inserted variable capacitors, it becomes possible to realize systems with better tuning characteristics over longer lines. It is also possible to optimize the electrical length of a line for the minimum necessary  $C_{\max}/C_{\min}$  overlap between capacitance. Figures 4; references 3 (Russian).

USSR

UDC 621.391

SYSTEMATIC ERRORS IN DIGITAL PROCESSING OF A QUASI-HARMONIC SIGNAL IN A FREQUENCY BAND

Moscow RADIOTEKHNIKA in Russian Vol 32 No 5, May 77 pp 30-35 manuscript received 11 Sep 75; after completion 6 Sep 76

ZHODZISHSKIY, M. I., and SELEZNEV, V. V.

[Abstract] Systematic errors are compared for different methods of digital processing of a quasi-harmonic signal in a frequency band. It is found that in the case of a narrow range of variation in the frequency of the input signal the more preferable systems (as being simpler) are those that combine the operations of analog-digital conversion and comparison of the input waveform with a reference signal. Where it is necessary to work in a wide frequency band, systems should be used that separate these operations because they enable widening the frequency band by two or three orders of magnitude without any change in the systematic error. Figures 3; references 11 (Russian).

## USE OF STRUCTURAL PROPERTIES OF NOISE SIGNALS FOR THEIR OBJECTIVE IDENTIFICATION

Leningrad IZVESTIYA VUZOV: PRIBOROSTROYENIYE in Russian Vol 20 No 4, 1977:pp 28-31 manuscript received 12 Jul 76

BELKIN, M. K., GALAYCHUK, G. L., GUDONAVICHYUS, R. V., CHITAVICHYUS, A. B., and YASTRAMSKAS, V. V.

[Abstract] The solution of problems of technical and medical diagnostics, processing of complex signals, acoustic exploration for useful minerals, and the like, often reduces to identification of noise signals. In this case it is possible to distinguish three basic stages of work: selection of the information attributes of the signals, synthesis of efficient resolving principles, and use of these principles for identification of unknown situations. The first stage is the most important because the complexity and efficiency of the resolving principles and, in the final account the quality of identification, depend on the properties of the attributes. During forming of signal attributes, a phase plane method which has received considerable development in recent years makes it possible to study signals by an analysis of their phase images. The present work considers the results of experimental tests of the efficiency of structural models with implicit time, for identification of two classes of mechanism noise. For selection of the attributes of phase images, the phase plane is divided into eight sectors with the aid of eight rays formed by the axes of coordinates and by the bisectors of the right angles between them. Two systems of integral parameters were used as attributes of the phase plane portrait: the number of intersections for a fixed length of time  $T$  of the phase image with each of the rays used, and also the stay time of the images of points in sectors of the plane. In order to form phase coordinates, the selection of the attributes mentioned and the input of information into an electronic computer, a special semidigital device was created. The paper was recommended by the Department of Radio Reception and Processing of Radio Engineering Information. Tables 1; references 7 (Russian).

USSR

UDC 621.391.8

VARIANCE OF A RANDOM OUTPUT PROCESS BECAUSE OF THE ACTION OF WHITE NOISE ON A NONSTATIONARY FILTER

Moscow RADIOTEKHNIKA in Russian Vol 32 No 5, May 77 pp 87-88 manuscript received 23 Oct 75; after completion 19 Jul 76

BUKHARIN, S. V., BERNSHTEYN, YA. M., and PONOMAREV, A. G.

[Abstract] A technique is proposed for analyzing a nonstationary filter in which a variable-gain amplifier stands at the input to a two-terminal pair network, assuming that white noise with a given spectral density acts on the amplifier input. The procedure is based on the method of state space, which in particular makes it easy to take random initial conditions into account when the normal form of equations of state is used, and gives the final dispersion equations in a recurrence form that is convenient for computer use. Investigation of the elements of the resultant variance matrix enables a more detailed analysis than when the classical approach is taken. In addition, the method of state space can be used to analyze multidimensional filters. References 4 (Russian).

USSR

UDC 621.391.14

STATISTICAL CHARACTERISTICS OF APERIODIC CORRELATION FUNCTIONS OF DISCRETE FREQUENCY SIGNALS

Kiev IZVESTIYA VUZOV: RADIOELEKTRONIKA in Russian Vol 20 No 3, Mar 77 pp 46-49 manuscript received 6 Oct 75

VARAKIN, L. YE., and MATVEYEVA, O. V.

[Abstract] Incomplete overlap of useful and interfering discrete frequency signals of the first order is considered and the statistical characteristics of their aperiodic correlation functions are established. An analysis of the coincidence distribution indicates that the probability of few coincidence is higher with aperiodic than with periodic correlation functions, which is preferable. Figures 2; tables 2; references 2: 1 Russian, 1 Western.

USSR

UDC 621.391.24

# ON ESTIMATING THE PRODUCT OF DURATION BY SPECTRAL WIDTH FOR CERTAIN SIGNALS

Moscow RADIOTEKHNIKA in Russian Vol 32 No 5, May 77 pp 27-35 manuscript received 11 Sep 76; after completion 6 Sep 76

VITKOV, M. G.

[Abstract] In designing data transmission equipment for artificial satellites and radio relay lines it is important to specify the limits of waveforms and spectra at fairly deep levels. Therefore the author takes a level of 40 dB as a basis in analyzing theoretical signals and pulse responses of both conventional filters and those of recent design. A table is given summarizing the values of the product of the signal duration  $T$  by the spectral width  $F$  for a number of bell-shaped signals. Circuits are given for filters that have amplitude-frequency characteristics corresponding to bell-shaped curves within 0.5 percent. The filters were synthesized by a Chebyshev-optimum technique. A special octave filter is synthesized with fast fading and a  $T \cdot F$  value considerably lower than that of all investigated signals with nonuniformity of amplitude-frequency characteristic in the range up to  $0.5 \Omega$  ( $\Omega = 2\pi F$ ) of less than 5 percent. The normalized parameters of all filters are summarized in a table. Curves are given for the pulse responses of the filters to an isolated delta pulse. Figures 3; tables 2; references 3 (Russian).

USSR

UDC 621.391.144

# NECESSARY RADIATION BANDWIDTH OF A RADIO SYSTEM WITH PM (PRM) SIGNALS

Moscow RADIOTEKHNIKA in Russian Vol 32 No 5, May 77 pp 7-13 manuscript received 19 Sep 75

GOL'DBERG, B. S., and KONOVALOV, G. V.

[Abstract] The necessary radiation frequency bandwidth is determined for radio systems with phase-keyed (PM, PRM) signals. The analysis is based on a study of distortions in various kinds of transmitted signals with consideration of the way that each received element is affected by all preceding and following elements. It is assumed that the radio signal is steady-state at the reception point. The following deterministic models of modulating signals are considered: 1) A pulse sequence of regularly alternating ones and zeros with equal duration and period equal to twice the pulse duration; 2) A sequence with predominance of zeros; and 3) A single pulse corresponding to "one" appearing against a background of an infinite sequence of zeros. The first model is found to correspond best to reality. Expressions are found that relate the necessary bandwidth of the emitted signal to permissible energy losses and the receiver passband. A numerical example is given. Figures 3; tables 2; references 6 (Russian).

USSR

UDC 621.394

CONCERNING TRANSMISSION OF DIGITAL TELEMETRY SIGNALS THROUGH WIRE CIRCUITS

Leningrad IZVESTIYA VUZOV: PRIBOROSTROYENIYE in Russian Vol 20 No 4, 1977  
pp 5-10 manuscript received 12 Jul 76

ZHIGACH, V. P., FEDOROV, S. A., KONSTANTINOV, S. N., and NOVIKOVA, I. F.,  
Leningrad Electrical Engineer Institute of Communications imeni Prof M. A.  
Bonch-Bruyevich

[Abstract] It is possible to use both existing communication channels as well as especial extended wire lines (physical circuits) for transmission of telemetric signals through wires. The present paper considers the noise effective in physical circuits and methods of preventing it. The study is limited to the case of digital telemetry when the information is transmitted by binary code video pulses. In order to increase noise immunity, it is proposed to include in the line the simplest type of pulse regenerator based on integrated logic circuits. Two telemetric lines were developed and tested under field conditions. One was fulfilled with the aid of PSRP-0.5 twisted conductors with regenerators based on Type KLLB331 microcircuits. The other circuit was formed with the aid of small-size coaxial cable with a characteristic impedance of 75 ohm. The regenerators were fulfilled on the basis of a series 109 "and" circuit. The paper was recommended by the Department of Line Communications. Figures 3; table 1; references 16: 15 Russian, 1 Western.

USSR

UDC 621.396.1

REAL-TIME SPECTRAL ANALYSIS OF DETERMINISTIC SIGNALS

Moscow RADIOTEKHNIKA in Russian Vol 32 No 5, May 77 pp 82-87

BURKOV, A. D., GRANKOV, A. G., GUSHCHIN, YU. YE., and CHECHETKIN, V. D.

[Abstract] An analysis is made of the feasibility of applying the Wiener-Khintchine theorem, which is basic in spectral correlation theory, to deterministic signals. To do this, the authors examine a number of characteristics of signals in the frequency and time regions (spectra and their time images). It is shown that the Wiener-Khintchine theorem relates the current and instantaneous autocorrelation functions to the spectral densities of the current energy and the instantaneous power of a deterministic signal. Table 1; reference 1 (Russian).

USSR

UDC 621.396.22.029.7

SELECTION OF REPEATER STATIONS IN A HYBRID SYSTEM FOR TRANSMISSION OF DISCRETE SIGNALS BY OPTICAL CABLE

Moscow RADIOTEKHNIKA in Russian Vol 32 No 5, May 77 pp 89-91 manuscript received 15 Sep 75; after completion 4 May 76

SKOMOROVSKIY, YU. A.

[Abstract] The author considers the design of an optical communication line with a hybrid system for transmitting discrete signals, from the standpoint of selecting the permissible number of repeater stations to be installed between the two nearest regeneration points, or between a regeneration point and a terminal station. Relations are found for the optimum number of repeaters as a function of noise level in the system, fading and length of the optical cable, the error at the reception point, and also the parameters of the laser, optical amplifier and photodetector. Figure 1; references 2 (Western).

EAST GERMANY

UNAFFECTED TRANSFER OF INFORMATION BETWEEN POINTS WITH EXTREMELY DIFFERENT  
POTENTIALS USING OPTICAL LINES

East Berlin NACHRICHTENTECHNIK ELEKTRONIK in German Vol 27 No 3, 1977 pp 97-98  
manuscript received 20 Sep 76

ERMISCH, J., Chamber of Technology, Electrical Engineering Section, Technical  
University, Dresden

[Abstract] In his paper presented at the 10th colloquim on information engineering, held at Dresden Technical University, the author discussed the features of optical transmission (high insensitivity to interference, a simple transmission path, and an ability to select the carrier frequencies freely because of the absence of any effect on other transmission channels), and the designing of optical transmission lines. In designing, attention must be given to the efficiency of the optical-electric components and the transmission degree, including the coupling sites, of the optical conductors. The type of modulation is another important factor: the best is when the average pulse performance does not depend on the degree of modulation. In the studies described, the GaAs diode VQ110(WF) was used, operated at currents of up to 500 mA. The length of the optical transmission bundle must be set according to the potential differences involved. At a voltage of about 100 kV, dependable transmission may be achieved with plastic conductors. Using a Si planar photodiode SP 101, the author was able to construct a simple optical receiver of high sensitivity. Figures 2; table 1; references 3 (German).

USSR

UDC 621.396.662

#### AN ASTATIC ANALOG-DIGITAL PHASE AFC SYSTEM

Moscow RADIOTEKHNIKA in Russian Vol 32 No 5, May 77 pp 36-41 manuscript received 24 Feb 76; after completion 26 May 76

SHAKHGIL'DYAN, V. V., and KARYAKIN, V. L.

[Abstract] The authors analyze the dynamics of a self-contained astatic analog-digital phase AFC system. The storage device in the system is a digital integrator which consists of a reversible counter, a counter control unit and a digital-to-analog converter. A block diagram of the system is given. A continuous method of analysis is used, based on different modifications of an averaging technique that covers a wide range of system parameters. Analytical expressions and graphs are given for determining the time of transient processes. An examination of phase portraits of the system shows that under any initial conditions a phase-locked state is reached. In an actual system the lock-in band is limited by the maximum possible mismatch for which the digital integrator can compensate. Figures 5; references 3 (Russian).

USSR

UDC 621.396.97

#### ESTABLISHING THE RECOVERY RESPONSE OF THE TRANSMISSION GAIN OF AUTOMATIC LEVEL CONTROL DEVICES

Moscow ELEKTROSVYAZ' in Russian No 3, Mar 77 pp 43-45 manuscript received 17 May 76

KUZNETSOV, E. B., and NYURENBERG, V. A.

[Abstract] Questions of the theoretical design of the recovery response of the transmission gain of automatic level control devices widely used in radio-broadcasting are treated, where this recovery is determined by the exponential law for the discharge of a capacitor in the control circuitry, and the shape of the response curve for the element being controlled. In determining the magnitude of the transmission gain at any point in the transient period following a sudden step drop in the signal level at the input of an exponential automatic level control device, instead of the actual recovery response, relative errors of up to 100-110 percent are possible. The mean arithmetical error in determining the transmission gain of an automatic level controller can attain 45 percent in this case. The difference between the actual and the design recovery time of level limiters amounts to  $0.3 - 0.6\tau_r$ , where  $\tau_r$  is the time constant of the controlling discharge circuit. It is possible to design the recovery response in developing automatic level control devices so as to provide for adequate design precision. The value of the transmission gain at any point in the transient period can be established with an error approximately less than that for exponential decay control. The calculated response

characteristics make it possible to determine the recovery time in automatic level control devices prior to their manufacture, and to select the optimum circuitry, operational mode and other parameters. Figures 6; references 3 (Russian).

USSR

UDC 621.398

CONCERNING THE SET OF TELEVISION TRANSMISSION PARAMETERS ACCEPTABLE FOR PULSE-CODE TELEMETERING WITH LIMIT DEVIATION RESTRICTION

Leningrad IZVESTIYA VUZOV: PRIBOROSTROYENIYE in Russian Vol 20 No 4, 1977 pp 113-117 manuscript received 21 Jun 76

BUTAYEV, G. M., North Caucasus Mining-Metallurgical Institute

[Abstract] The paper is concerned with pulse-code telemetering with an indication part. A method is presented for determining the set of television parameters acceptable for achieving television transmission of a given magnitude, a function  $x(t)$ , with a required precision. The region of television transmission parameters acceptable for telemetering of a specified magnitude  $x(t)$  is shown in a figure. In addition, the parameters are determined of television transmission with a minimum expenditure of the frequency bands of the communication channel. The paper was recommended by the Department of Industrial Electronics. Figures 1; references 1 (Russian).

EAST GERMANY

SELECTION OF CLOCK FILTERS IN PULSE-CODE-MODULATED REPEATERS

East Berlin NACHRICHTENTECHNIK ELEKTRONIK in German Vol 27 No 3, 1977 pp 92-93 manuscript received 20 Sep 76

KOHLSCHMIDT, R., Chamber of Technology, Communications Engineering Area, Information Technology and Theoretical Electrical Engineering Section, Technical University, Ilmenau

[Abstract] Various types of clock filters were compared in terms of their performance characteristics in general, and of their performance as jitter low-pass filter [TP = Tiffpass] components in particular. In his paper delivered at the 10th colloquium on information technology held at Dresden Technical University, the author stated that (1) The bandwidth, and thus the effective value of the jitter perturbances increases if the filters get out of tune; (2) The jitter-reducing ability of the filter decreases with an increasing degree of coupling to oscillating circuits; (3) A novel compensation circuit described in the literature (H. Marko et al: NTF Vol 42 pp 170-188) is not suitable for repeaters; (4) Although aftertuned oscillating circuits are insensitive to parameter drift, they cause increased jitter; and (5) PLL circuits give extremely high performance but economic considerations may mitigate against their use. Figures 5; tables 2; references 5 (German).

USSR

UDC 656.25.551.50

## ENGINEERING DIAGNOSIS OF AUTOMATION AND TELEMCHANICAL SYSTEMS

Moscow AVTOMATIKA TELEMCHANIKA I SVYAZ' in Russian No 4, Apr 77 pp 5-7

DMITRENKO, I. YE., Head of Department of Automation and Telemchanics, All-Union Correspondence Institute of Railroad Transportation Engineers, candidate of technical sciences; SAKHNIN, A. A., dotsant, candidate of technical sciences; DURNEV, A. I., head, Engineering Department, Main Administration of Signalization and Communication, USSR Ministry of Railroads

[Abstract] In most cases a change in the performance parameters from nominal to limiting levels is gradual, rather than sudden, and engineering diagnosis requires a complex system of instruments which automatically measure and record these changes affecting individual components, so as to indicate the need for replacement before a fault occurs. A typical automatic block system for the railroads is shown here which operates on numerically coded information at 25 Hz, with five data transmitters and eight fault indicators connected to it. Depending on the form of information and on the mode of measurement, the instruments are current or potential devices, have active (with supply source) or passive (without supply source) circuits, discrete (in time) operation with a single or several thresholds being preferred for this application. The primary information is channeled from the control object through the primary measuring instruments to a line point for gathering and analysis, from here to an intermediate station for decoding, logic processing, and recording; then to a station panel for display and control (if diagnostic information is not required) and further to the central station for decoding, logic processing, and control (if diagnostic information is required). Prototypes of such a system and its components are now being tested. Figures 5.

USSR

UDC 656.25:621.315.2

## INVESTIGATION OF CHARACTERISTICS OF MKPAB-TYPE CABLES OVER A WIDE FREQUENCY RANGE

Moscow AVTOMATIKA TELEMCHANIKA I SVYAZ' in Russian No 4, Apr 77 pp 8-9

NAFTOL'SKIY, M. V., graduate student, LIIZhT [Leningrad Institute of Railroad Transportation Engineers imeni Academician V. N. Obratsov]

[Abstract] The use of pulse-code-modulation techniques in railroad communication systems requires that such apparatus operate in parallel with existing apparatus for frequency division of channels. A main cable for a semiautomatic block system with multiplexing of PCM and FD data transmission has been developed and its characteristics over the 12-252 kHz frequency range (range of frequency division between channels) have already been established. An investigation was made at the LIIZhT laboratories to determine its characteristics

at higher frequencies ranging up to 10 MHz. Its primary parameters (R,L,C,G) over the 0.25-10 MHz range were calculated according to conventional formulas. Its secondary parameters (wave impedance and attenuation factor) could be calculated only on a semiempirical basis, with the structural design parameters taken into account and appropriate numerical constants inserted into the theoretical relations. Of special further interest was measurement of the near-end crosstalk attenuation and the far-end shielding level. An evaluation of the results indicates that this cable is suitable, with additional symmetrization, for simultaneous transmission of analog and digital data without exceeding permissible interference levels. Figures 2; table 1.

USSR

UDC 656.254.16:62-50

#### COMPUTER-AIDED DESIGN OF RADIO RELAYING LINES

Moscow AVTOMATIKA TELEMEXHANIKA I SVYAZ' in Russian No 4, Apr 77 pp 10-11

DZYGALO, YU. A., engineer, GIPROTPANSSIGNALSBIYAZ' [State Planning and Surveying Institute for the Planning of Signalization, Centralization, Communication, and Radio in Railroad Transportation]

[Abstract] The design of radio relaying lines must ensure stability of the communication link and the necessary signal-to-noise ratio for satisfactory performance. The conventional graphic-analytical method is tedious and requires a great deal of practical experience in specialized areas. Consequently, a design program has been developed for implementation on a model "NAIRI-2" electronic computer. This program consists of two parts. The first part, containing 25 operators, yields the stability of a line under given meteorological conditions and with the earth's curvature taken into account. It also yields data for the second part, in which the attenuation factor corresponding to the average dielectric permittivity of air as well as its value exceeded during 80 percent of the service time. The second part, containing 19 operators, yields also the performance parameters such as the signal power entering the receivers (average power and power level exceeded during 80 percent of the service time) and the thermal-noise power (average and average-per-minute exceeded during 20 percent of the service time). The computer results should be and have been checked against test data, for design control as well as proper tuneup and installation. The use of a computer reduces the total engineering time from 121.5 to 18 h. Tables 1.

EAST GERMANY/CZECHOSLOVAKIA

INCREASING THE RELIABILITY OF COMMUNICATION NETWORKS BY THE DISTRIBUTION OF THE CONNECTIONS AMONG TRANSMISSION LINES WHICH ARE INDEPENDENT OF EACH OTHER

East Berlin NACHRICHTENTECHNIK ELEKTRONIK in German Vol 27 No 3, 1977 pp 115-117 manuscript received 15 Dec 75

TRSTENSKY, D., Transportation College, Zilina, Czechoslovakia

[Abstract] The reliability of communication networks may be significantly increased by distribution of the connections among mutually unaffected transmission lines. This can be accomplished at little expense and at a satisfactory degree of redundancy by means of the approach described. It is based on characterization of the communication network by a graph. The reliability is expressed as the probability of existence of a minimum number of direct channels between two points of a network. The value of the approach described was demonstrated by the relationship between the network reliability and the number of independent paths at various characteristic curve distributions. The network reliability may be further increased by separating it into independent sectors. This will result in decreased traffic loss. Figures 3; references 4: 2 Czechoslovakian; 2 Russian.

Components and Circuit Elements Including  
Waveguides and Cavity Resonators

USSR

UDC 621.372.54

FILTER FOR SMOOTHING OF RANDOM SIGNALS

Leningrad IZVESTIYA VUZOV: PRIBOROSTROYENIYE in Russian Vol 20 No 4, 1977  
pp 17-19 manuscript received 26 Jul 76

VOLKOV, I. I., MOTOV, V. V., and SEMENYCHEV, V. K., Kuybyshev Polytechnical  
Institute imeni V. V. Kubyshv

[Abstract] A filter is proposed which combines a simple equipment solution with constant parameters, and a sufficiently high precision of smoothing the signals of certain random processes often encountered in automatics, radio engineering, acoustics and biology, the mathematical description of which is approximated by a polynomial in time of the order  $N$  ( $N = 0, 1, 2, \dots$ ) with a constant coefficient. The paper was recommended by the Department of Information-Measuring Technics. Figures 1; references 4 (Russian).

USSR

UDC 621.372.061

REALIZATION OF REJECTION OR PHASE FILTERS ON THE BASIS OF A DIFFERENTIAL  
OPERATIONAL AMPLIFIER

Kiev IZVESTIYA VUZOV: RADIOELEKTRONIKA in Russian Vol 20 No 3, Mar 77 pp 71-  
77 manuscript received 15 Jul 75

UZUNOV, I. S., V. I. Lenin Higher Institute of Machinery and Electrical En-  
gineering, Sofia, Bulgaria

[Abstract] Restrictions on the location of zeroes in the transfer function of simple active RC filters with multiloop feedback can be removed by the use of a differential operational amplifier with the signal appearing simultaneously at both inputs. This concept is now generalized to any active RC filter. The desired nonminimal-phase transfer function of a bandpass, with zeroes on the imaginary axis or in the right-hand half-plane, is realized by feeding the signal to the noninverting input of the operational amplifier through an additional passive RC network. Figures 7; references 5: 2 Russian, 3 Western.

USSR

UDC 621.372.63.061.2

#### GYRATOR CIRCUITS WITH VARIABLE GYRATION IMMITANCES

Kiev IZVESTIYA VUZOV SSSR: RADIOELEKTRONIKA in Russian Vol 20 No 1, 1977  
pp 85-86 manuscript received 17 Nov 75

BONDARENKO, A. V., GRIBANOV, A. F., and GORBUNOV, O. I.

[Abstract] A study of matrices of gyration immitances on amplifiers with finite and near-unity coefficients of amplification was made. Two specific ways to realize this matrix were examined. The circuit of a gyrator which allows the gyration immitances to be varied both by varying the coefficient of amplification of the second amplifier and by varying the size of the paired resistances was described. The oscillatory circuits built with the suggested gyrators guarantee a quality on the order of 100-200 in the upper part of the frequency range of 10-15 Hz. Figures 3; references 3 (Russian).

USSR

UDC 621.372.82

#### CALCULATION OF THE SCATTERING MATRIX FOR MULTIMODAL WAVEGUIDE TRANSFORMERS

Kiev IZVESTIYA VUZOV: RADIOELEKTRONIKA in Russian Vol 20 No 3, Mar 77 pp 103-105 manuscript received 23 Jun 75

LOZYANOV, V. I., ONUFRIYENKO, V. M., and PROKHODA, I. G.

[Abstract] The method of partly intersection regions is applied to the calculation of the scattering matrix for hollow transformers built with multimodal waveguides. Partition of a complex region (within which the field of a waveguide transformer is defined) into simple subregions and or expansion of partly intersecting regions has, with the aid of Green's second theorem and the use of Green's functions, reduced the problem to Fredholm integral equations of the second kind. The analytical results are compared here with numerical data pertaining to a rectangular waveguide and to two waveguides coupled through a rectangular hole in their common narrow wall. Figures 3; references 2 (Russian).

USSR

UDC 621.372.62:681.3

PARAMETRIC SYNTHESIS OF WIDEBAND TRANSFORMERS OF FULL IMPEDANCES OF LUMPED-DISTRIBUTED STRUCTURE

Kiev IZVESTIYA VUZOV: RADIOELEKTRONIKA in Russian Vol 20 No 3, Mar 77 pp 65-70 manuscript received 16 Jul 75

BELLON, O. O., KOTLYAR, M. YA., LEYCHENKO, YU. D., and MASHARSKIY, YE. I.

[Abstract] The problem of designing a wideband impedance with lumped-distributed parameters is treated as a problem of minimizing a function of many variables which characterizes the departure of actual performance characteristics from desired ones, and of predicting the optimal states. The problem has been formulated in these terms and a computer program has been developed for solving it which selects, automatically, or depending on the form of the target function or the dimensionality of the variables vector, any of the following methods of optimization: random search, variable metrics, rotating coordinates, and steepest descent. Combining the random search with deterministic processes resolves some difficulties in the synthesis of lumped-distributed structures and renders the algorithm universal, applicable also without a priori information about the target function. There is no need here for finding an "adequate" initial approximation. The specificity of constraints makes it feasible to select the ranges of parameters most suitable for practical realization of circuit components. For illustration, the algorithm is applied to the design of a microwave-power transistorized amplifier with a matching stage consisting of five circuit elements. Typical values of the matching circuit parameters are shown, optimized on the basis of the SWR as a function of the frequency (over the 500-800 MHz range) as well as of the frequency characteristics of input and output parameters (resistances and reactances). Figures 3; tables 2; references 5: 2 Russian, 3 Western.

USSR

UDC 621.373.852.6

A WIDEBAND IMPEDANCE TRANSFORMER WITH DISTRIBUTED PARAMETERS

Moscow ELEKTROSVYAZ' in Russian No 3, Mar 77 pp 59-63 manuscript received 30 Jul 73

SHAPIRO, L. YA.

[Abstract] The basic design equations for an impedance transformer with distributed parameters (TDP) are derived in matrix form using multiport network theory. The expressions derived are presented in tabular form and take both low-loss and lossy lines into account. A design example is presented for a wideband, distributed parameter, 1:4 impedance converter. The design procedure is applicable to transformers in the VHF range, their passbands and core types are discussed and the possibility of using them to create wideband

amplifiers and other devices necessary for the construction of multichannel communications lines, in particular television communications lines, is indicated. The author thanks V. P. Bogdanov and V. V. Semenov for participation in the tuning and experimental investigation of a TDP. Figures 3; table 1; references 6: 4 Russian, 2 Western.

USSR

UDC 621.396.621.55

#### A MULTIFUNCTIONAL DISCRIMINATOR

Moscow RADIOTEKHNIKA in Russian Vol 32 No 5, May 77 pp 106-108 manuscript received 26 Jan 76, after completion 28 Oct 76

BESSONOV, V. V.

[Abstract] The paper describes a discriminator that can perform the functions of a high-frequency amplitude discriminator that is not sensitive to the difference in phases of input voltages, or the functions of a frequency detector with phase-frequency response that can be shifted along the vertical axis by a control signal. The device contains adders, amplifiers, square-law detectors, a subtractor and a phase inverter. The parameters of the device determine the functions performed. Figures 2; references 4 (Russian).

USSR

UDC [62-83:621.313.12-181.4.083.8]001.2

## CONVERSION OF INFORMATION FROM A MULTIPURPOSE TRANSDUCER FOR AUTOMATIZED MICRODRIVES

Moscow ELEKTRICHESTVO in Russian No 5, May 77 pp 59-65 manuscript received 11 Nov 76

USYSHKIN, YE. I., and ZEL'DIN, V. SH., Moscow

[Abstract] At present, various types of microdrives with closed structures for their control and regulation have had considerable development. Improvement of the dynamic and energy properties of the drives as well as the possibility of creating drives with new regulation properties, not accomplished by open systems, has been attained. Examples of such drives are the so-called thyatron motors, electric drives with a system of stabilization or synchronization of the speed of rotation, and position tracking drives. Further improvement of systems of automatized control requires a combination of the above properties in one type of drive with the possibility of a successive change of one regime or another in the course of operation of the process of control of the drive. To do this, it is necessary to create a new transducer capable of producing information, the extent of which is sufficient for control of drives in all operating conditions. It is shown that all the information necessary for control of drives can be derived from one transducer of a special type designated as multipurpose (MPT). The transducer is a miniature electromachine of a type of noncontact selsyn. The principal feature distinguishing the MPT from a selsyn lies in the fact that it is used in a phase regime, during which, because of the supply of external multiphase voltage to it, the phase windings in the hollow of its stator effect the rotary field. With a sufficiently high frequency  $f_0$ , the signal of the output winding of the MPT gives information practically constant in time, concerning the value of the angular coordinate of the rotor, independent of the change of the speed of rotation and the supply voltage of the MPT, and presented in the form of the phase of this signal. A method is proposed for conversion of the signal transducer--stroboconversion, which makes it possible with the aid of logic devices to obtain from the MPT a system of phase signals, and step and code-position signals, as well as to accomplish all operations which may be necessary for control of microdrives. Using a MPT, the authors (in a separate paper) developed a number of synchronous noncontact variable electric drives with an independent power supply. The drives have significant merits. Figures 3; references 10 (Russian).

USSR

UDC 778.534.4

PROGRESS IN THE TECHNOLOGY OF SOUND RECORDING FOR MOVIES

Moscow TEKHNKA KINO I TELEVIDENIYA in Russian No 4, Apr 77 pp 14-22

ROZINKINA, T. YU., Movie Studio "Mosfil'm"

[Abstract] Magnetic sound recording constitutes a major step in the development of movie production. The progress over the last 25 years is reviewed here in terms of four generations of equipment, including microphones, voice and music mixer panels, magnet tape, recording and playback heads, transcribers, and duplicators. The last generation available is a completely standardized and transistorized series. The electroacoustic performance characteristics have improved consistently, but there are further goals ahead, namely: achieving higher reliability and stability as well as narrowing the tolerances on the performance parameters. Tables 8; references 19: 16 Russian, 3 Western.

USSR

UDC 621.391.14

AUTOCORRELATION INTERFERENCE FUNCTION FOR PULSE-PHASE MODULATED SIGNALS IN THE TROPOSPHERIC CHANNEL

Moscow RADIOTEKHNIKA in Russian Vol 32 No 5, May 77 pp 81-82 manuscript received after completion 1 Jul 76

ARBUZOV, YU. V.

[Abstract] The author investigates propagation of pulse-phase modulated signals in the troposphere on the basis of an experimental technique described in a previous article [see Yu. V. Arbuzov, "Radiotekhnika," Vol 30 No 4, 1975]. The experimentally found law of distribution of fluctuations of the pulse front is treated as a law of interference distribution for the transmitted signals. The evaluate changes in the spectrum of a message transmitted by pulse-phase modulation, the autocorrelation function of the interference was found. The results can be used to predict changes in the spectrum of the output signal within practically realizable frequency ranges and over practically feasible tropospheric transmission paths. Figures 2; references 5 (Russian).

Certain Aspects of Computer Hard and Soft Ware;  
Control, Automation and Machine Planning

USSR

UDC 62-501.72

COMPUTER DESIGN OF COMPLICATED ELECTRONIC SYSTEMS BY THE SUBCIRCUIT METHOD

Moscow TEKHNIЧЕСКАЯ КИБЕРНЕТИКА in Russian No 1, Jan/Feb 1977 pp 193-197  
manuscript received 18 Mar 75

GURARIY, M. M., and RUSAKOV, S. G., Moscow

[Abstract] The method of multiterminal subcircuits has begun to be widely used in automated computer design of large-scale integrated circuits and other complicated electronic systems, in programs which entail automatic writing of model equations. As a rule algorithms employing this method are based on formal methods of solving large systems of linear equations obtained by linearization at each step of the computation process for the main system. But this approach does not take into account the fact that at each step in computation various subcircuits differ substantially in their degree of nonlinearity and inertia. In a complicated electronic circuit the rate of occurrence of processes in various components at each moment of time is usually quite different. As a result, independent integration of systems of equations for each subcircuit in order to conform with the actual nature of its operation in the large-scale system would make possible a considerable reduction in machine time for modeling. The present paper demonstrates that an algorithm suggested by one of the authors in an earlier paper, which makes it possible to set up independent computation processes for each subcircuit and thus speed up the modeling process, is a more general solution than the approach normally used. Another purpose of this paper is to arrive at key equations for modeling complicated nonlinear circuits with systems of transcendental and ordinary differential equations with a different number of iterations or integration steps for different subcircuits. A flow chart is shown for the algorithm for making computations at a specific step in integration. This method is shown to be superior to methods employing integration by parts of systems of linear equations. Independence of computation processes for different subcircuits will enable efficient use in the future of computing systems of the parallel type in the computer design of large-scale integrated circuits. The method of modeling suggested here can be used in studying complicated systems of different physical types. Figure 1; references 4 (Russian).

## MAGNETO-GERKON DECIMAL DISPLACEMENT DIGITIZER

Leningrad IZVESTIYA VUZOV: PRIBOROSTROYENIYE in Russian Vol 20 No 2, 1977  
pp 50-54 manuscript received 6 Apr 76

MIRONENKO, A. A., Urals Polytechnical Institute imeni S. M. Kirova

[Abstract] Converters of displacement into code (CDC) with gerkons [magnetically controlled contacts] are widely used in technology. The specific properties of CDC lie in the fact that it is impossible to use ordinary binary or decimal scales in them because of the impossibility of physical and structural realization of the code disks (CD). In this respect use of one-track combinatorial scales with a length of successive identical adjacent symbols of not less than an assigned magnitude shows promise. However, they have a nonarithmetical output that requires conversion, which complicates the corresponding system. The present paper discusses a decimal magneto-gerkon angle-to-code converter, free from this shortcoming, which was proposed in a 1976 patent by A. A. Mironenko, the author, and Yu. S. Sharin. The converter has a decimal output, but in it there is no ambiguity of readout, characteristic of converters with a distributive output, because the distributive output is not univariable. This is attained as the result of construction of the converter on the basis of a ring-shaped coding device, which produces a univariable code 1 or 2 of 5, and an arrangement of supplementary gerkons, during which all the gerkons are united according to a scheme of conversion of a code 1 or 2 of 5 into a distributing output. Determination of the instrumental and dynamic errors of readout is essential during design of such converters. The results are presented of investigations of dynamic errors conducted on a special unit containing a code disk with a magnetic system and a photoshutter [fotozaslonka] controlling a photodiode. At present the converter described is used in a system of digital indication, intended for operation under heavy-duty conditions. The paper was recommended by the Department of Semiconductor and Electrovacuum Machine Construction. Figures 6; references 6 (Russian).

USSR

UDC 631.325.3

RING CODING DEVICES FOR BINARY-DECIMAL POSITION CODES

Leningrad IZVESTIYA VUZOV: PRIBOROSTROYENIYE in Russian Vol 20 No 2, 1977  
pp 74-77 manuscript received 29 Apr 76

SHARIN, YU. S., and IL'NITSKIY, V. I., Urals Polytechnical Institute imeni  
S. M. Kirova

[Abstract] Relationships are presented on the basis of which the authors determine the parameters of ring coding devices (of code combination scale and code combinations, which represent the position of readout elements of position readout rings) for all existing binary-decimal weighted codes, including arithmetical. It is found that the ring coding devices structures for binary-decimal weighted codes, can be divided into three types, drawings of which are presented. The parameters of some ring coding devices are presented in a table. The ring coding devices described make it possible to obtain a simple and economical design of converters of the angle of rotation into a code for various automation systems. The paper was recommended by the Department of Semiconductors And Electrovacuum Machine Construction. Figures 1; tables 1; references 3 (Russian).

USSR

UDC 621.327.08

METHODS FOR CHECKING THE FUNCTIONING AND THE DIAGNOSTIC OF INTEGRATED SEMI-CONDUCTOR OPERATIONAL MEMORY DEVICES

Kiev IZVESTIYA VUZOV SSSR: RADIOELEKTRONIKA in Russian Vol 20 No 1, 1977 pp 41-44 manuscript received 20 Oct 75; after revision 11 May 76

KVARTSOV, A. D., KRYUKOV, V. P., ZOLOTAREV, T. V., IVANNIKOV, A. Z., and  
TOROPOV, A. D.

[Abstract] An algorithm is proposed for monitoring the functioning and the diagnostic of types of defects in plates and casings of operational semiconductor memory devices. An arbitrary choice of information and a high information capacity of the memory matrix is employed. Structural diagrams for constructing a program of tests and an automated system for checking the layouts by means of a computer are given. The process was found to be functionally complete and of a high degree of productivity. Figures 3; references 2 (Russian).

CONCERNING THE POSSIBILITY OF USING LINEAR PIEZOCERAMICS FOR CONSTRUCTION OF  
ANALOG STORAGE DEVICES

Leningrad IZVESTIYA VUZOV: PRIBOROSTROYENIYE in Russian Vol 20 No 4, 1977  
pp 70-74 manuscript received 24 Jun 76

ALIYEV, T. M., DZHAGUPOV, R. G., VAYSMAN, G. S., and MAMEDOV, R. K., Azerbayd-  
zhan Institute of Petroleum and Chemistry imeni M. A. Azisbekova

[Abstract] Use of analog piezoceramic storage devices (SD) makes it possible to store a large number of signals which are bounded by the upper limit of the linear section of a piezotransducer. Such SD are necessary during development of electron beam devices for presentation of information (displays, location indicators, etc.). Storage of high-voltage signals in the deflection circuits of indicators makes it possible to accomplish repeated representation of individual signals. As shown in the literature, information recorded in a piezoelectric SD remains constant during a long time, which is determined by the aging time of the ceramic, and readout is accomplished without its destruction. The SD is characterized by high efficiency and considerable radiation resistance. The basic elements of the SD are explained, and experimental investigations of regimes of recording, readout and erasing in piezoceramic analog SD made of TsTS-19 ceramic made it possible to establish a number of relationships necessary during planning of similar devices. The paper was recommended by the Department of Electrical Measurements and Computing Techniques. Figures 4; references 5 (Russian).

## THE MICROPROCESSOR--THE FUTURE OF ELECTRONICS

Warsaw ELEKTRONIKA in Polish No 3, 1977 pp 89-92

SOWINSKI, ANDRZEJ

[Abstract] The article describes the structure of a microprocessor and its properties and discusses the types of microprocessors produced by leading firms: INTEL, NATIONAL, SEMICONDUCTOR, MOTOROLA and ROCKWELL. The software of microprocessing systems is examined and the possible applications of microprocessors in computerized systems, control and measuring operations, etc. are also discussed. It is assumed that by 1980 the majority of measuring apparatus will be based on microprocessors, and that by that time the microprocessing system of the class of minicomputer PDP-11 with 16-bit central processing unit and memories RAM and ROM with 4K x 16 bits store capacity will be available. The complete microprocessor will measure 4 x 6" and its price will not exceed \$50. Figures 5; table 1.

USSR

UDC 621.385.832.82

DESIGN OF MEMORY DEVICES WITH VIDICONS

Moscow TEKHNIIKA KINO I TELEVIDENIYA in Russian No 4, Apr 77 pp 55-57

BEZRUKOV, V. N., and ANAN'IN, A. V., Novosibirsk Electrotechnical Institute of Communication, Khabarovsk Branch

[Abstract] The performance characteristics of vidicons have been improved so much since the nineteen sixties that these devices may be used in memory systems for time multiplexing of TV channels. An analysis shows that optimum performance is obtained with a low dark-current target resistance and a special signal shape, including a negative step in the readout field. The difficulties caused by the nonlinear amplitude characteristic of vidicons and the non-uniformity of the delayed signal have been overcome most effectively by subdividing the signal and the noise spectrally, the LF signal delayed with a transformation of the FM spectrum and the HF signal delayed without. A trade-off is necessary here between high noise immunity of the LF channel and low flicker intensity of HF signal components, determined by the flare of the aperture characteristic of a vidicon as well as by the modulation index. Vertical aperture correction is feasible in modern vidicons, while both additive and multiplicative noise can be reduced most effectively by discrete signal processing. Figures 5; references 6: 5 Russian, 1 Western.

USSR

UDC 621.391.6

DETERMINATION OF MINIMUM ADMISSIBLE NUMBER OF LINES IN A RASTER DURING MEASUREMENT OF THE COORDINATES OF A POINT SOURCE

Leningrad IZVESTIYA VUZOV: PRIBOROSTROYENIYE in Russian Vol 20 No 4, 1977 pp 86-88 manuscript received 9 Sep 76

KATARGIN, M. YU., Chelyabinsk Polytechnical Institute

[Abstract] Television methods are increasingly used for measurement of the coordinates and linear dimensions of objects. The present paper evaluates the effect of the discreteness of the line structure of a television raster on the error of determining the coordinates of a point source. With line scanning, the complete video signal from a point source at the output of a transmitter television tube can be described in a formula as a sequence of pulses of bell form without a bell envelope. This formula is correct for tubes without storage of energy. For tubes with stored energy, the description of the signal in the formula can be used only as approximate because of the influence of the "pulsation-adaptation" effect. The signal at the output of the television tube is observed as an additive noise of the television tube and amplifier. The paper was recommended by the Department of Automatic Control Systems. Figures 1; references 3 (Russian).

USSR

UDC 621.397.132.08

AN INSTRUMENT FOR MEASURING THE DIFFERENTIAL GAIN IN COLOR-TV CHANNELS

Moscow TEKHNIIKA KINO I TELEVIDENIYA in Russian No 4, Apr 77 pp 58-60

MEDVEDEV, YU. A., and KRUKOVSKIY, YU. P.

[Abstract] An instrument has been designed and built which measures the differential gain in TV channels within the necessary 0.01-0.025 percent accuracy. With the switch in the "measure" position, the fourpole network under investigation is connected into the feedback circuit of a blocking oscillator whose output and feedback characteristics are identical. The amplitude of harmonics is stable only as long as the transfer ratio of the feedback circuit remains constant. Any finite change in the latter produces a monotonic change in the amplitude of oscillations. The instrument also includes a filter, a pulse generator, a controlled amplifier, a summator, and an indicator. With the switch in the "calibrate" position, the fourpole channel is out of the feedback circuit. The pulse generator consists of a horizontal-frequency multivibrator, a switch, and a pulse-voltage amplifier with a regulating resistor in the output stage. Another resistor adjusts the sensitivity of the instrument. Figures 3; references 4: 2 Russian, 2 Western.

USSR

UDC 778.5:621.397.13

EVALUATION OF VIDEO FILMS PRODUCTION BY THE ELECTRONIC EDITING PROCESS

Moscow TEKHNIIKA KINO I TELEVIDENIYA in Russian No 4, Apr 77 pp 3-7

MAKOVEYEV, V. G., UAKIN, YE. S., and ZAGOROVSKIY, K. O., All-Union Scientific Research Institute of Television and Radio Broadcasting

[Abstract] Video-phonograms are edited by appropriate tape cutting and splicing. The electronic process has been developed to the highest level of perfection, but it is very expensive. One must, therefore, select the proper technique on the basis of such considerations as layout precision, program sources synchronization, signal phasing, and error elimination. Meanwhile, the process must also be optimized in terms of minimum display time relative to viewers' response and fatigue characteristics. The whole problem is mathematically analyzed here with the aid of probability theory, and general results are obtained which may be applicable to specific cases. Figures 3; references 12: 10 Russian, 2 Western.

USSR

UDC 621.396.662

A FREQUENCY STABILIZING SYSTEM WITH A SUPERCONDUCTING RESONATOR

Moscow ELEKTROSVYAZ' in Russian No 3, Mar 77 pp 76-77 manuscript received 3 May 72

MENDE, F. F., PRENTSLAU, N. N., KOZLOVSKIY, O. P. [deceased], TRUBITSYN, A. V., and BONDARENKO, I. N.

[Abstract] A frequency stabilizing system for the microwave range with a superconducting resonator is described. An evacuated, superconducting lead resonator which had a loaded  $Q$  of  $2 \cdot 10^7$  at a temperature of  $4.2^\circ$  was used as the calibrating resonator in an experimental study of the regulating system. A reflex klystron with an output power of about 50 - 60 mW was used as a reference oscillator. The relative mean square instability when a crystal oscillator was used for the IF amounted to  $2.8 \cdot 10^{-10}$  over 1 hour, and  $5 \cdot 10^{-10}$  over 1 hour where a frequency synthesizer was used. A brief account of the system is supplemented by a block diagram and a description of the phase locked loop frequency control circuitry. The authors thank B. I. Verkin for interest in the work, and V. A. Kushnir for assistance in conducting experiments. Figure 1; references 2 (Russian).

USSR

UDC 531.25

STATISTICAL ANALYZER OF TIME INTERVALS WITH VISUAL DISPLAYS

Leningrad IZVESTIYA VUZOV: PRIBOROSTROYENIYE in Russian Vol 20 No 4, 1977 pp 10-16 manuscript received 4 May 76

BELYAYEV, O. K., GAVRA, T. D., and YERMOLENKO, N. A., Leningrad Polytechnical Institute imeni M. A. Kalinin

[Abstract] The distinctive feature of the statistical analyzer of time intervals developed by the authors, achieved by the method of delayed coincidences, is the use for pulse counting at the output of each channel and display of the results, of Type IN-20 hundred-point counting-indicator gas-discharge tubes. These small-size and narrow-profile devices are already used for presentation of the results of statistical analysis of instantaneous values of random processes, and their use makes it possible substantially to simplify the display unit of the analyzer. The analyzer, which contains 11 channels, is adapted for measurement and visual display of histograms of the differential distributions of the instability of the period of quasi-harmonic signals. A functional diagram of the analyzers is presented and the principle of action is illustrated by a diagram of the voltages at various points of the circuit. It is noted that the resolution of the analyzer during an investigation of high-frequency signals can be substantially increased if a statistical analysis is performed of the products of low-frequency pulsations of the generator in question with a more stable standard generator or with a generator identical with the one being investigated but with some different frequency. For this purpose there is a wide-band ring mixer in the composition of the analyzer which was developed. The paper was recommended by the Radio Engineering Department. Figures 4; table 1; references 8 (Russian).

USSR

UDC 535.8 621.3.038

PASSAGE OF POLARIZED EMISSION THROUGH A LINEAR  $\lambda/4$  PHASE PLATE AND AN ANGLE REFLECTOR

Leningrad IZVESTIYA VUZOV: PRIBOROSTROYENIYE in Russian Vol 20 No 2, 1977 pp 123-125 manuscript received 18 May 76

KOROTAYEV, V. V., MUSYAKOV, V. L., and PANKOV, E. D., Leningrad Institute of Precision Mechanics and Optics

[Abstract] References are found in the literature to experimental and theoretical investigations of the passage of linear-polarized emission with a rotating oscillation plane (OP) of the vector of the electric field intensity, through an angle reflector (AR) with metallized reflecting sides. As follows from this work, after the stationary analyzer a flow of emission is observed, intensity modulated with a frequency equal to double the frequency of rotation

of the OP, as well as a negligible decrease of the percentage modulation as compared to the flow passing through the analyzer in the absence of an AR. The present paper investigates the passage of such emission through an AR with a  $\lambda/4$  linear phase plate mounted before it, with a subsequent analysis of the emission by a polarized analyzer. The scheme discussed can be used for the creation of a highly-sensitive phase device for measurement of the relative position of objects distributed in space with reference to their connecting (twisting) axis. With absence of rotation of the polarizer-analyzer (i.e., with  $\omega = 0$ ), measurement of movement is possible by an amplitude method cited in the literature. The paper was recommended by the Department of Optical-Electronic Devices. References 4 (Russian).

USSR

UDC 621.317

METHOD FOR REDUCING THE ERROR OF QUANTIZATION IN A DIGITAL TRACKING PHASE METERING SYSTEM

Kiev IZVESTIYA VUZOV SSSR: RADIOELEKTRONIKA in Russian Vol 20 No 1, 1977 pp 23-28 manuscript received 11 Nov 75; after revision 20 May 76

PARFENOV, G. A.

[Abstract] A method for reducing the error in quantization in a digital tracking phase measuring system was studied. This method involves noise phase modulation of the reference signal and averaging of the numerical values of the detected phase difference at the output of the digital tracking system. Conditions necessary for the existence of an unbiased competent estimate of the quantity to be measured were determined. However, a slight bias does exist, thus limiting the possibilities of using this method to make the measurements. Figures 4; references 2: 1 Russian, 1 Western.

USSR

UDC 621:317.799/550.837

ELECTROMAGNETIC DETECTION OF CONDUCTING MEDIA

Kiev IZVESTIYA VUZOV SSSR: RADIOELEKTRONIKA in Russian Vol 20 No 1, 1977 pp 11-16 manuscript received 4 Feb 76; after revision 13 May 76

SHAYDUROV, G. YA.

[Abstract] Electromagnetic detection and recognition of objects found in conducting media are studied. This problem is compared with that of radar detection in air. Ways for improving the maximum detection parameters are given. The features listed are characteristic of numerous applied problems such as

the design of low-frequency directional antennas, the synthesis of optimum probe signals and detection receivers, the creation of recognition methods based on electromagnetic signal signs, the development of methods of statistical description and procedures for suppressing synchronous noise. Solution to these problems permits reducing the technical level of any system for the electromagnetic detection of media to one corresponding to the state of the art of modern radar and may be used to develop a uniform approach to the planning of such systems using the statistical theory of detection and recognition. Figures 3; references 9: 8 Russian, 1 Western.

USSR

UDC 681.3

#### IDENTIFICATION OF SPEECH SOUNDS BY THE METHOD OF MATCHED FILTRATION

Leningrad IZVESTIYA VUZOV: PRIBOROSTROYENIYE in Russian Vol 20 No 2, 1977  
pp 21-25 manuscript received 13 May 76

KUZNETSOV, P. G., Izhevskiy Mechanical Institute

[Abstract] Use of certain concepts and methods of matched filtration of signals for identification of speech at the phoneme level is proposed. A block diagram is presented of a device based on matched filters for identification by phon. Among other units the device contains a filter matched with one period of the fundamental tone, a separator of pulses of the fundamental tone, a switch, and a delay element. The principal advantages of the proposed approach are considered as well as variations of its achievement. The results are presented of an experimental test of the proposed method, conducted on isolated vowel phonemes of Russian speech for one speaker. The paper was recommended by the Department of Technology of Instrument Manufacture. Figures 2; table 1; references 7 (Russian).

USSR

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# CALCULATION OF LINEAR ELECTRIC CIRCUITS BY PARTS

Moscow ELEKTRICHESTVO in Russian No 5, May 77 pp 41-48 manuscript received  
6 May 76

SHAKIROV, M. A., candidate of technical sciences Leningrad

[Abstract] Continued complication of radioelectronic apparatus and automatic devices leads to the necessity for an investigation of electric circuits [tsep'] which contain hundreds and thousands of branches. In connection with this, interest increases in methods of analysis of complex circuits and systems by parts, called "diacoptica." One of the effective methods of diacoptics is a method based on the use of fictitious sources in place of separation of circuits. In the present paper it is shown that diacoptic methods can be obtained without use of the concept of orthogonal circuits. At its base lies the idea of representation of the individual parts of an electric circuit in the form of equivalent multidimensional sources, which constitute multipole or multicircuit generators, the interior circuit of which does not contain loops [kontur] or junctions [uzel]. The parameters of the generator can be calculated by any known method of measured experimentally. Generalized algorithms of calculation by parts of the circuits are formulated, which are disconnected not only by the division of the coupling junctions of the subcircuits, but also by closing of these junctions. During this the circuits can consist of both uniform y- and z-branches and branches of different types. Linear circuits are considered which consist of y- and z-branches, between which can be nonmutual controlling connections corresponding to dependent sources; the Y-branch can be controlling only with respect to voltage, and the z-branch with respect to current. Conventional positive directions of current and voltage in the branch are considered to be coincidental; the y-branch can contain a parallel-connected nonmutual source of current, and the z-branch a series-connected nonmutual source of emf. A condition of positive direction of voltage at the emf source is considered a reverse direction of the emf. During calculation by parts every circuit is divided into subcircuits, the branches of which are connected and the subcircuits themselves do not have a controlling connection between themselves. It is concluded that the essence of the proposed approach to calculation of linear circuits by parts involves substitution of circuits of subcircuits by circuits of diequivalent generators, consisting either of a tree-circuit or supplementary--circuit subcircuits. Thus, diacoptics is presented only as a method of conversion of the individual parts of an electric circuit, and in this sense are generalized elementary conversions and simplifications, applicable in practice, of the schemes of circuits for facilitation of calculations. With such treatment clear representation of the diacoptic is attained which makes it possible to formulate generalized algorithms for circuits with uniform and hybrid parameters, not fastening to any of the specific methods of calculating subcircuits or united circuits. During processing of concrete algorithms for calculation of these circuits, together with matrices, there can also be used the methods of signalling graphs, transfer methods, methods of structural numbers, etc. It is possible to conduct separation of subcircuits not only with respect to junctions but also to branches because in place of separation it is always possible to form a junction, dividing the branch into two parts. It is possible to use these branches

as connection branches between subcircuits. Freedom of action remains and during choice of the tactics of solution: part of the subcircuits can be a substitution corresponding to their diequivalent generators; the other part to equivalent generators, and as residual subcircuits can remain without change (not simplified). The approach to the diacoptic of circuits described in the work can be used for explanation of the physical meaning of tensor-matrix procedures found in the literature and the development of their connection with the method of G. Ye. Pukhov used in the present work. The method described is illustrated by examples. Figures 4; tables 4; references 10: 9 Russian, 1 Western.

USSR

UDC 621.382.82:53.072:681.32

AN ALGORITHM FOR SIMULATION OF INTEGRATED CIRCUITS TAKING INTO ACCOUNT THEIR NONLINEAR CHARACTERISTICS

Kiev IZVESTIYA VUZOV: RADIOELEKTRONIKA in Russian Vol 20 No 3, Mar 77 pp 50-59 manuscript received 11 Jul 75

NIKOLAYENKO, V. M., PARASOCHKIN, V. A., and SAMKOV, YE. YA.

[Abstract] Rather simple relations describing the model of an integrated-circuit electron device, simulated on a computer in the form of a nonlinear n-pole network, are derived here by the method of state variables. Starting with the tree diagram of a typical analog amplifier, through the topological matrix and the component matrix, equations of state with hybrid parameters are obtained which take into account topological degeneracy as well as circuit nonlinearities (input and output capacitances as well as transmission and feedback coefficients). The solution is obtained with the aid of asymptotic approximating aggregates, which require an experimental determination of the statistical distributions of current-voltage relations. In the "dynamic" part of this model those asymptotic aggregates and the algorithm for generating a quasi-random function are then used for the variation of parameters within the limits of their statistical dispersions. Figures 3; references 3 (Russian).

USSR

UDC 621.382.82.993

PERCENT OF THE YIELD OF USEFUL INTEGRATED CIRCUITS

Kiev IZVESTIYA VUZOV SSSR: RADIOELEKTRONIKA in Russian Vol 20 No 1, 1977 pp 81-83 manuscript received 22 Oct 75

KONOPEL'KO, V. K.

[Abstract] The author reports on computations of the probability of producing useful circuits; here, he assumes that the defects are distributed uniformly both over the surface of the plates and among them. He defines such circuits as an exponential dependence, according to which the integrated circuit output is decreased as the integrated circuit area is increased. The results given in this article agree well with experimental data. References 5: 2 Russian, 3 Western.

USSR

UDC 621.396.69.001.2

MODELING THE DIMENSIONAL STRUCTURE OF RADIOELECTRONIC DEVICES DURING THE LAYOUT PHASE

Kiev IZVESTIYA VUZOV SSSR: RADIOELEKTRONIKA in Russian Vol 20 No 1, 1977 pp 3-10 manuscript received 7 Jun 76

MOCHALOV, B. V., and YERMOLAYEV, YU. P.

[Abstract] The problem of the substantiation of the dimensional structure of radioelectronic devices during the layout phase and prior to the development of the major schematic diagrams is examined. Solution of the problem is of a probability nature and is found by the use of the statistical dependence of the qualitative indices of the planned device on the dimensional structure. Experimental dependences which can be used in engineering computations are cited. Figures 4; references 4 (Russian).

USSR

UDC 621.373.52

INCREASING THE STABILITY OF AN RC OSCILLATOR

Moscow ELEKTROSVYAZ' in Russian No 3, Mar 77 pp 68-71 manuscript received 4 Nov 74

DOLGIN, V. P.

[Abstract] The RC oscillator analyzed is a split Wien bridge oscillator designed around a two stage transistor amplifier using RC networks. The use of a field effect transistor in a nonlinear feedback circuit is the means of increasing the oscillator stability. Design calculation expressions are derived and an example of the calculation and experimental results are provided. Figures 2; references 1 (Russian).

USSR

UDC 621.375.018

CORRECTION OF PULSE SHAPES OF GENERATORS WITH DISCHARGE OF THE STORAGE LINE THROUGH AN AVALANCHE TRANSISTOR

Kiev IZVESTIYA VUZOV SSSR: RADIOELEKTRONIKA in Russian Vol 20 No 1, 1977 pp 79-81 manuscript received 20 Oct 75; after revision 13 Feb 76

D'YAKONOV, V. P.

[Abstract] The author uses a high-speed discharger (spark, thyatron or relay) as the method of discharging a storage line to produce square-wave pulses with a duration up to 100 nanoseconds. The author suggests a promising method i.e., the use of avalanche transistors in the generators. He suggests that the pulse amplitudes can be increased to 100 V by using higher voltage silicon epitaxial transistors in place of the avalanche transistors. Figures 2; references 4 (Russian).

USSR

UDC 621.378.33

A LASER RADIATION SOURCE FOR PRACTICAL INTERFEROMETRY

Moscow KVANTOVAYA ELEKTRONIKA in Russian Vol 4 No 4, Apr 77 pp 880-882  
manuscript received 18 Feb 76

NAZARENKO, M. M., RYBAKOV, B. V., SEREBYAKOV, G. S., SKULACHENKO, S. S., and  
YUDIN, I. I.

[Abstract] This report, presented at the Second All-Union Symposium on Gaseous-Laser Physics (Novosibirsk, June 1975), contains experimental data which indicate the feasibility of a rather simple laser radiation source with a frequency stability on the order of  $10^{-11}$  within an averaging time of 1 minute. Such a source was built on a bimodal helium-neon ring laser inside a circularly anisotropic resonator without modulation of the resonator length, operating at the 0.63  $\mu\text{m}$  wavelength. The dispersion of Zeeman beat frequencies was used for stabilization and tuning. One deficiency of this instrument, common to all those which use the center of the gain curve as the reference point, is its poor reproducibility. This does not constitute a major drawback, however, in most practical applications of interferometry. Figure 1; references 5 (Russian).

USSR

UDC 621.378.325

SINGLE-FREQUENCY GARNET LASER WITH A WAVEGUIDE RESONATOR

Moscow KVANTOVAYA ELEKTRONIKA in Russian Vol 4 No 4, Apr 77 pp 783-786 manuscript received 17 Jun 76

GLUSHCHENKO, N. F., D'YACHENKO, V. V., MIKAELIAN, A. L., and TSAREV, P. P.

[Abstract] An experimental study has been made to verify that waveguide resonators eliminate the effects of thermo-optical distortion within the active medium of solid-state lasers and thus contribute to the high coherence of the laser beam. A garnet specimen 5x5x90 mm large was placed inside a Fabry-Perot resonator and then inside a waveguide resonator, with the pumping power varied up to the breakdown level. Interference and polarization measurements have revealed that in a waveguide resonator such a laser operates in a single-frequency mode of generation, regardless as to whether or not thermo-optical distortions are averaged in one or two planes and up to pumping levels causing crystal fracture (7.0 kW). Such a laser also operates in a single transverse mode at pumping levels up to 5.0 kW, corresponding to 30 kW output power with the use of plane mirrors. Figures 7; references 3 (Russian).

USSR

UDC 621.391.2

METHOD OF STOCHASTIC APPROXIMATION IN THE ADAPTATION PROBLEM INVOLVING A COMB FILTER FOR SUPPRESSION OF CORRELATION NOISE

Kiev IZVESTIYA VUZOV: RADIOELEKTRONIKA in Russian Vol 20 No 3, Mar 77 pp 34-39 manuscript received 14 Nov 75

AKIMOV, P. S., and DUPLISHCHEV, A. V.

[Abstract] Problems of signal filtration with incomplete a priori data and of synthesizing an optimum filter are usually solved by adaptation methods. Here, a stationary correlation noise is considered, with a comb-like spectral density because of reflections from a large target, and the problem of adaptively tuning an N-order nonrecursive filter for suppressing this noise in radar receivers is solved, with an algorithm conveniently broken down into two: one for the real coordinates and one for the imaginary coordinates of the  $\bar{C}$ -vector (vector-column of network coefficients). As a specific example, this algorithm is applied to a second-order filter and the performance characteristics (adaptation time and noise suppression level) of the latter are evaluated. This adaptation algorithm has also been simulated on a digital computer. Figures 5; references 5 (Russian).

USSR

UDC 621.396

SEARCHING OUT A RADIO SIGNAL IN A COMPLEX NAVIGATION SYSTEM

Kiev IZVESTIYA VUZOV: RADIOELEKTRONIKA in Russian Vol 20 No 3, Mar 77 pp 23-28 manuscript received 8 Oct 75

OZERSKIY, YU. P.

[Abstract] With several independently operational navigation systems installed on board a moving object, it is desirable to interlink them so as to improve the effectiveness of each. An example is the simultaneous operation of radar systems such as a digital range finder coupled to an autonomous readout unit. The effectiveness of searching out the return signal with such equipment and the optimization of the system parameters are evaluated here on the basis of an algorithm for sequential analysis which uses uniform a priori data. Figure 1; references 5: 4 Russian, 1 Western.

USSR

UDC 621.397.962.33:621.391.82

PROCESSING OF RADAR SIGNALS DURING WOBBLE OF THE REPETITION RATE OF PROBING PULSES

Kiev IZVESTIYA VUZOV: RADIOELEKTRONIKA in Russian Vol 20 No 3, Mar 77 pp 40-45 manuscript received 18 Dec 75

NOVOSEL'TSEV, L. YA., and FLYAGIN, A. YE.

[Abstract] Most modern radar systems operate with a wobbling repetition rate of the probing pulses. An optimal algorithm is constructed here for processing signals at the receiver input which consist of a deterministic component (with given initial phase, Doppler frequency shift, and packet envelope) and a passive noise with a given interperiodic correlation. Specifically, the case of two-step wobble is considered and the said algorithm shown as consisting of operations for the conventional coherent case supplemented with functional transformations (the latter required because the signal-to-noise ratio at the output) becomes a function of the initial phase. This dependence weakens, however, with a larger number of pulses in a packet and with a more nearly rectangular packet envelope. A system for processing signals on the maximum-likelihood principle and realizing quasi-optimal algorithms is a multichannel one, with respect to the radial velocity of a target, whose output signals are pairwise functionally transformed. These transformations determine the feasibility of evaluating the Doppler frequency shift over a wider range than possible merely on the basis of the repetition rate. Figures 2; references 2: 1 Russian, 1 Western.

USSR

UDC 621.372.51

ON SELECTING THE NUMBER OF SWITCHABLE FILTERS FOR WIDE-BAND RADIO TRANSMITTERS

Moscow RADIOTEKHNIKA in Russian Vol 32 No 5, May 77 pp 101-104 manuscript received 26 Dec 75; after completion 28 Nov 76

KOZYREV, V. B.

[Abstract] The author considers the problem of choosing the number of switchable filters at the output of wide-band transmitters. It is found that for a given engagement factor  $K_f = \omega_u / \omega_l$  (where  $\omega_u$  and  $\omega_l$  are the upper and lower frequency limits of the transmitter passband) there is an optimum number of switchable filters  $k = k_{opt}$  for which the number of reactive elements of all  $k$  filters will be minimized. The value of  $k_{opt}$  is independent of the required damping to be introduced by the filters on the  $n$ -th harmonic, or the permissible damping in the passband of the filters. For maximally smooth amplitude-frequency response, bandpass filters contain fewer reactive elements than low-frequency filters; for equally fluctuating amplitude-frequency response, low-frequency filters have fewer reactive elements. In the case of filtration of the second harmonic, if  $k = k_{opt}$  the engagement factor of the individual filters is 1.4-1.6, i.e., the filters are far from the octave passband. Figures 4; references 2 (Russian).

USSR

UDC 621.396.62:621.396.8

NOISE IMMUNITY OF AN IDEAL FM RADIO RECEIVER

Kiev IZVESTIYA VUZOV: RADIOELEKTRONIKA in Russian Vol 20 No 3, Mar 77 pp 98-102 manuscript received 26 Feb 76; after revision 5 Jul 76

PAVLOV, B. A.

[Abstract] An ideal ultrashort-wave broadcast receiver is analyzed for the purpose of determining to what extent FM demodulators can lower the threshold. The transmission capacities of the HF channel and the LF channel are assumed to be equal. They are calculated from the frequency-dependent joint probability density of signal and noise amplitude. The noise immunity, i.e., the improvement in the signal-to-noise ratio from receiver input to receiver output is established, both above and below the threshold. The respective formulas are based also on subjective data on the psychophysiological characteristics of the ear and measurements made with a proportional-integrating filter. Figures 3; references 4 (Russian).

USSR

UDC 621.396.621

CONCERNING THE MUTUAL RELATION BETWEEN ESTIMATES OF THE DYNAMIC RANGE OF A RECEIVER WITH RESPECT TO BLOCKING, CROSS MODULATION AND INTERMODULATION

Moscow RADIOTEKHNIKA in Russian Vol 32 No 5, May 77 pp 93-96 manuscript received 4 Feb 75; after completion 13 Oct 76

SILIN, A. V.

[Abstract] An analysis is made of the mutual relation between values of the dynamic range of a receiver with limitations caused by different kinds of non-linear distortions (blocking, cross modulation and intermodulation). It is shown that the dynamic range with respect to third-order intermodulation can be used as a parameter that describes the dynamic properties of a receiver. Figures 3; references 6 (Russian).

POLAND

UDC 621.382.2

DEVELOPMENT OF THE PRODUCTION OF THYRISTORS AND RECTIFYING DIODES

Warsaw ELEKTRONIKA in Polish Vol 17 No 3, 1977 pp 103-108

MICHALOWICZ, JERZY, ZE Unitra-Lamina

[Abstract] The author discusses the development of the world's technology in the domain and production of the active structures and design of semiconductor elements of high-power rectifying diodes and thyristors. He describes in detail the production program of the ZE Unitra-Lamina plant which started to manufacture the above elements in 1976 and which is based on an American license. The annual appearance of some 120,000 diodes and 100,000 thyristors on the domestic market will provide a wide range of modern and rational solutions in the electronic industry and will result in great energy conservation for the national economy. It will also provide export opportunities inasmuch as foreign markets in this field are especially attractive and absorptive. Tables 2.

POLAND

UDC 621.382.2

STRONG-SIGNAL MODEL OF A TUNNEL DIODE

Warsaw ELEKTRONIKA in Polish Vol 17 No 2, 1977 pp 73-75

RUSEK, ANDRZEJ, Institute of Fundamentals of Electronics, Warsaw Polytechnic

[Abstract] A strong-signal model of a germanium tunnel diode for standard-step generators is described. The nonlinear junction capacity and other parasitic elements are included. The influence of important elements on time characteristics of the tunnel diode is demonstrated. The selected results of the numerical analysis and the results of measurements are given. Figures 5; references 8: 3 Polish, 1 Russian, 4 Western.

USSR

UDC 519.25

CONCERNING TWO-DIMENSIONAL APPARATUS ANALYSIS OF RANDOM PROCESSES

Leningrad IZVESTIYA VUZOV: PRIBOROSTROYENIYE in Russian Vol 20 No 4, 1977 pp 20-24 manuscript received 23 Jun 76

GOL'DBERG, N. I., All-Union Correspondence Polytechnical Institute

[Abstract] As shown in the literature, development of methods and creation of devices for apparatus analysis of random processes is taking place in the field of one-dimensional spectral and correlation analysis. However, constantly increasing requirements and more complete a priori information concerning useful signals and interference, lead as well to the development of methods and devices for experimental determination of two-dimensional functions and densities of probability distributions. In the present work a method is considered for two-dimensional apparatus analysis of random processes based on an experimental determination of the reference values of a two-dimensional characteristic function found in two previous papers by the author. It is shown that in a number of cases, use of this method is preferable to others. The paper was recommended by the Department of Automatics and Telemechanics. Figures 3; references 12 (Russian).

USSR

UDC 537.212

CALCULATION OF TEMPERATURE FIELD OF ELECTRICAL WINDINGS WITH DIRECT COOLING

Novocherkassk IZVESTIYA VUZOV: ELEKTROMEKHANIKА in Russian No 4, 1977 pp 376-381

ALEKSIDZE, MERAB ALEKSANDROVICH, dr of physico-mathematical sciences, prof of Computing Center, Academy of Sciences, GrSSSR, and POPOV, VICTOR VASIL'YEVICH, candidate in technical sciences, dotsent Leningrad Polytechnical Institute

[Abstract] A boundary problem is formulated for the temperature field in the insulation of electrical windings with direct cooling of the active conductors for a length-wise circuit. It is assumed that the thermotechnics of the materials of the winding and the cooling agent do not depend on the temperature, and the cooling gas in the gap has null temperature. An analysis is made by the net-point method of an approximate solution of the problem formulated. An analysis of the dependences obtained shows that it is necessary to take into account the change of heat release from the temperature in calculating the temperature field in question for cores of relatively long length. Figures 3; references 4 (Russian).

## TO AN ANALYSIS OF SYNCHRONIZATION SYSTEMS WITH AMPLITUDE-FREQUENCY MODULATION OF A CONTROL SIGNAL

Novocherkassk IZVESTIYA VUZOV: ELEKTROMEKHANIKA in Russian No 4, 1977 pp 382-387 manuscript received 20 Mar 74

KUZNETSOV, VLADIMIR PETROVICH, candidate in technical sciences, dotsent Minsk Radio Engineer Institute, and PAVLIK, MIKHAIL VASIL'YEVICH, senior engineer, Design Office Of Precision Electric Machine Construction (Minsk)

[Abstract] Systems of synchronization of electric motor drives or oscillators based on the principle of pulse-phase automatic frequency control are widely used in practice. Such systems employ as comparison elements (CE) coincidence circuits with a locking device or a reversible counter, into one input of which a highly-stable standard voltage is fed and into the other a pulse from the output of the synchronization object. Information concerning the phase difference of the signals is contained in the amplitude of the pulse at the output of the CE and enters discretely into the moments of arrival of pulses from the output of the tunable oscillator. Because of destabilizing factors, as well as the transient conditions, the frequency at the output of the system changes in the course of time, which leads to a change of the frequency of information removal. Thus, a system of synchronization with the type of CE mentioned pertains to a class of systems with amplitude-frequency modulation (AFM) of a control system. In the present paper the problem is raised of developing a method of analysis of a dynamic system with AFM in a synchronization regime. The method of investigation, based on a description of processes by nonlinear difference equations, with subsequent linearizations of them, is similar in many respects to a method discussed in two works of which V. P. Kuznetsov (see above) is coauthor, where systems with pulse-duration modulation are investigated. The procedure indicated is not standard as applied to synchronization systems. The linearization of the equations makes it possible to investigate the stability and quality of transient processes as well as to calculate the reaction of the system during change of the perturbing effect. Conditions for stability are derived, which limit the range of possible values of the system parameters. Figures 3; references 7 (Russian).

USSR

UDC 621.373

STUDY OF THE PEAKING OF THE FRONTS OF NANOSECOND PULSES USING SATURABLE REACTORS

Kiev IZVESTIYA VUZOV SSSR: RADIOELEKTRONIKA in Russian Vol 20 No 1, 1977 pp 17-22 manuscript received 18 Mar 76

VIZIR', V. A.

[Abstract] A theoretical study of peaking of the fronts of pulse in circuits with saturable reactors was made. An expression is obtained for the optimal magnetic field strength in the core of a choke coil for which a minimum time duration is guaranteed for the pulse being shaped. The author computes the dependence of the coefficient of shortening of the duration of the pulse front as a function of the parameters of the choke coil and the peaked pulse. The data found by the author in this article agree well with those found by other researchers for saturating choke coils on ferrites and have been experimentally confirmed. Figures 4; tables 1; references 7: 6 Russian, 1 Western.

USSR

UDC 621.382

EVALUATING THE FUNCTIONAL POSSIBILITIES OF RADIOELECTRONIC COMPONENTS, ASSEMBLIES AND SYSTEMS

Kiev IZVESTIYA VUZOV SSSR: RADIOELEKTRONIKA in Russian Vol 20 No 1, 1977 pp 104-106 manuscript received 30 May 75, after revision 11 May 76

KOVALEV, I. P.

[Abstract] The author reports on an attempt to introduce some means which would permit a comparison to be made among the various components, assemblies, and systems used in great diversity in radioelectronics. He makes the evaluation based on the great variety of functions performed by them and on their functional possibilities. Prior to this research all comparison has been made intuitively without quantitative analysis. It is hoped that an information approach to quantitative analysis will be useful because it allows use of the mathematical apparatus to construct complex radioelectronic systems. Figures 2; references 4 (Russian).

ELECTRICAL ENGINEERING  
General Production Technology

POLAND

INTERNATIONAL SPECIALIZED EXHIBITIONS, POZNAN 1976

Warsaw ELEKTRONIKA in Polish Vol 17 No 2, 1977 pp 79-83

TRUSZ, W.

[Abstract] Between 8 and 12 October, 1976, international specialized exhibitions accompanied by technical symposia were held in Poznan. These exhibitions were organized by the Publicity Office of the Publicity and Foreign-Trade Publications Enterprise AGPOL, in close cooperation with Industries - Export - Interessen, GmbH, Solingen FRG, and the Institute of Scientific Policy and Higher Education of the Poznan Polytechnic. Three exhibitions were displayed viz: 1) Woodworking machines; 2) Machine tools and instruments; and 3) Devices for audiovision, measurement, automation and scientific technical investigations. The joint area of the exhibition was 15,000 m<sup>2</sup> and occupied three halls. The article deals with the third show in which 345 exhibitors from 10 countries participated. The greatest number of exhibitors (40) were from FRG, and those from Switzerland (30) and Austria (16) ranked next. The United States was represented by 9 exhibitors and Japan by 3. The article describes in some detail the exhibits displayed by the following firms: AHLBORN MESS- UND REGELUNGSTECHNIK (8150 Holzkirchen - FRG); HOMMELWERKE GmbH (6800 Mannheim 41 - FRG); KARL DEUTSCH PRUF - UND MESS GERATEBAU (D-5600 Wuppertal 1 - FRG); REVOX - CONCO (8105 Regensdorf - Switzerland); MODERNE MASCHINEN - APPARATE - WERKZEUGE AG (8750 Glarus - Switzerland); SCHARCO-ELEKTRONIK (5600 Wuppertal 2 - FRG); WISSENSCHAFTLICH - TECHNISCHE WERKSTATTEN WTW (8120 Weilheim - FRG); ELMATIK GmbH (8081 Bréitbrunn/A - FRG); CANON (Tokyo 108 - Japan; represented by Canon Export GmbH 1150 Vienna - Austria); HEIDENHAIN (8225 Traunreut - FRG); LASER - OPTRONIC GmbH (8000 Munich 50 - FRG); STROHLEIN (4 Dusseldorf 1 - FRG); ATLAS COPCO ABEM AB (16120 Bromma - Sweden); BBC METRAWATT GmbH (8500 Nurnberg - FRG); HEWLETT PACKARD (represented by Biuro Informacji Technicznej, 00-950 Warsaw, ul. Stawki 2). Figures 19.

POLAND

UDC 621.75:621.385

NEW METHODS OF WIRE-LESS ASSEMBLY OF SEMICONDUCTOR ELEMENTS AND MONOLITHIC INTEGRATED CIRCUITS

Warsaw ELEKTRONIKA in Polish Vol 17 No 2, 1977 pp 57-61

SZCZEPANSKI, ZBIGNIEW, Institute of Electronic Engineering, Warsaw Polytechnic

[Abstract] New methods for assembly of semiconductor structures designed to replace wire bonding, such as flip-chip, beam-lead chip, spider bonding and STD (semiconductor-thermoplastic-dielectric), are discussed. Advantages and disadvantages of the methods in question are discussed. Figures 11; references 7: 1 Polish, 6 Western.

POLAND

UDC 621.317.1:621.382

ACCELERATED STEP-STRESS RELIABILITY TESTING OF SEMICONDUCTOR ELEMENTS

Warsaw ELEKTRONIKA in Polish Vol 17 No 2, 1977 pp 61-64

GLADYSZ, HENRYK, and KOLODZIEJSKI, JERZY, Industrial Institute of Electronics

[Abstract] The authors present the theoretical principles and techniques of accelerated step-stress reliability testing of active semiconductor elements and integrated circuits. Figures 5; tables 4; references 17: 6 Polish, 11 Western.

USSR

UDC 621.372.061:681.142

STATEMENT OF PROBLEMS OF DESIGN OF SYSTEMS OF MONITORING AND DIAGNOSIS OF  
FAULTS

Kiev IZVESTIYA VUZOV: RADIOELEKTRONIKA in Russian Vol 20 No 3, Mar 77 pp 110-  
112 manuscript received 2 Dec 75

BEZMENOV, A. V., graduate student, Czech College of Engineering, Prague,  
Czechoslovakia

[Abstract] The problem of designing a system for monitoring and diagnosis of electron devices is formulated here in terms of two goals, namely: adopting an available method and implementing the developed algorithm on a model MIR electronic computer. Using the adaptation and self-adaptation principle, one proceeds with the design of such an optimum system in three steps: 1) Selecting the penalty function, 2) Defining the parameters of the decision rule, and 3) Optimizing the system with respect to minimum engineering losses (determining the dimensionality and the scale of the components in the inspection-points space). The last step constitutes a rather difficult problem in itself and is treated here more thoroughly in the mathematical formulation of the design procedure. References 2 (Western).

USSR

UDC 621.313.3.045.5

"ACCURATE" ARMATURE WINDING FOR A-C MACHINES

Moscow ELEKTRICHESTVO in Russian No 5, May 77 pp 48-55 manuscript received  
21 Oct 76

POPOV, D. A., dr of technical sciences, prof Moscow

[Abstract] There is an increasing demand for electrical machines of low power and micromachines with special windings, which have high filtering properties and which assure a form close to sinusoidal of the phases of the magnetizing force  $F(x)$  or the phases of the emf. Of existing coil windings, the best filtering properties are possessed by the so-called "accurate" windings, the winding coefficient  $K_w$  of which equals zero for all the higher spatial harmonics of the field except harmonics with the exponents  $\nu = kN_L \pm 1$ . "Accurate" armature windings achieve an optimum stepped approximation of an ideal winding function, because with a specified number  $N_L$  (a specified number of steps of a winding function) of the spectrum of their winding functions contains a minimum number of higher harmonics. The following "accurate" armature windings are discussed: 1) Sinusoidal windings (a. sinusoidal concentric or heterocoil windings consisting of coils of different widths; and b. sinusoidal equal-coil windings which have a coil with a width  $y = \gamma$ ); and 2) Fan equal-coil windings. Brief consideration is given to the characteristics of sinusoidal and fan windings. Figures 5; tables 2; references 5 (Russian).

EAST GERMANY

ACQUISITION OF SINGLE INTERFERENCE SIGNAL

East Berlin NACHRICHRENTTECHNIK ELEKTRONIK in German Vol 27 No 3, 1977 pp 98-100 manuscript received 20 Sep 76

PLONTKE, J., Karl-Marx-Stadt

[Abstract] A device for the classification of the amplitudes of interference signals was developed. It classifies the signals into eight categories at a maximum sequence frequency of 1 MHz. The threshold values of the analog-to-digital converter are between 100 mV and 800 mV in 100 mV increments. Minimum recordable pulse width is 250 nsec, and the measuring time may be varied between 15 minutes and 24 hours. The recording process is triggered by the elapse of a preselected measuring time or a counter status of 9999. Manual triggering is also possible. The time may be printed out between two recording processes too. The device is made largely of TTL components of the Series D10. Because the device is primarily a pulse-height classifier, it can acquire and determine the amplitudes of an interference signal in a measuring site during a selectable time interval. These signals are stored and recorded after classification. Measurements over an extended period of time would permit the collection of statistical data. It may be useful in electrical lines and information transmission systems of machine tool and power plant industries. The device is simple to use and versatile. Block and circuit diagrams are presented. Figures 5.

USSR

## THE VULS-2 RECTIFIER UNIT

Moscow ELEKTROSVYAZ' in Russian No 3, Mar 77 pp 79-80

[Abstract] VULS-2 rectifier units are intended for powering the equipment of large communications facilities, long distance telephone exchanges, line equipment shops and automatic telephone exchanges, without storage batteries in a dual path system configuration. Each VULS-2 unit consists of two rectifiers and one filter cabinet. A table lists the operating parameters of the different models of this series. The advantages of the VULS series equipment over previous units are cited as an increase in the operational efficiency, a decrease in the size and weight, as well as improved dynamic characteristics as regards the amplitude and time response to transient processes. The AC input power for the six units of the series ranges from 2.8 to 15.6 KW and the efficiency from 0.62 to 0.82. Figures 1; tables 1.

USSR

UDC [621.311:621.314.261].001.8

CONCERNING THE USE OF ELECTROMECHANICAL FREQUENCY CONVERTERS IN POWER SYSTEMS

Moscow ELEKTRICHESTVO in Russian No 4, Apr 77 pp 10-15 manuscript received 21 Jun 76

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[Abstract] The paper considers possible means of developing electric power systems based on the use of electromechanical frequency converters (EMFC). A review is given of the use in world practice of converters. Use in the unified electric power systems (UEPS) of the USSR of electro-magnetic-sectionalized electric power transmission (EPTL) with asynchronized electromechanical frequency converters as system-generating lines makes it possible: 1) To conduct separate frequency control in connected subsystems, and, because of this to use more fully under emergency conditions the controlling effect of a load, and a short-lived reduction of frequency permissible in power-deficient subsystems. Thus it is possible to decrease the hot reserve of power in subsystems and in all the UEPS as a whole; 2) To employ in system generating not only a line of increased transmitting capacity at ultrahigh voltage, but also a line of low transmitting capacity, because with the aid of an asynchronized EMFC it is possible with comparative simplicity to control the return flows of exchange power through intersystem connections, ensuring in so doing the necessary reserves for stability of the system; and 3) To connect into the UEPS, USSR, the individual newly-created electric power systems at increased frequency. Preliminary calculations show that in a number of cases electromagnetic-sectionalized EPTL with an asynchronized synchronous machine power of 200--500 MWatt, not only with respect to technical but also to economic indices can be competitive in comparison with direct current insertion and EPTL. Apparently there are no particular problems in the preparation of systems of control and excitation of asynchronized synchronous machines of such EPTL, but there are definite difficulties in part of the planning and construction of strictly electrical machines. However, the cumulative tests in this area in the USSR and foreign countries make it possible to consider that these complications can be surmounted. Figures 3; references 19: 14 Russian, 5 Western.

SPECIAL FEATURES OF STARTING 6--10 kV THYRISTORIZED FREQUENCY CONVERTERS WITH AN INDEPENDENT CURRENT INVERTER

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[Abstract] The paper considers the special features of starting a high-voltage converter with an independent current inverter, with two-stage artificial switching, the circuitry of which is fulfilled on the basis of thyristorized blocks. The principal circuit of the converter is shown and is discussed. The following points are examined: 1) Supply of power voltage [the equivalent circuit is shown of a) a rectifier with power supply; and b) a converter with starting of the rectifier based on a "nonprepared" inverter]; 2) Control of double "spike" pulses; 3) Control of "wide" pulses; 4) Limitation of starting current; 5) Starting conditions of independent inverter; and 6) Diagrams of principal operations of automatic starting. It is concluded that planning of thyristor control systems and the automatics of power frequency converters must be conducted with an allowance made for their interaction, during which separation takes place of a complex region of starting into a number of transient processes, not superposable one on another, because only in this case can reliability of starting be assured. The algorithm of operation and the structure of the starting automatics of a power frequency converter prove simplest if the system of control of thyristors generates pulses of  $120^\circ$ . Figures 5; references 10 (Russian).

USSR

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## COMPUTER ANALYSIS OF THE FREQUENCY CHARACTERISTICS OF KLYSTRON AMPLIFIERS AND MULTIPLIERS OPERATING AT HIGH POWER LEVELS

Kiev IZVESTIYA VUZOV: RADIOELEKTRONIKA in Russian Vol 20 No 3, Mar 77 pp 116-118 manuscript received 23 Feb 76

GOLOSOV, P. G., and MALYSHEV, V. A.

[Abstract] The expression for the efficiency of power transmission by the  $n$ -th harmonic in a klystron tube is transformed and modified to

$$K_{n0} = \frac{[1 + p^2(y - y_0)^2]^2}{[1 + (y - y_0)^2]^{n+2} [1 + q^2(y + y_0)^2]}$$

so as to make it suitable for analyzing the amplitude-frequency characteristics of such a device by the iterative method on a model MIR electronic computer. Of practical interest are the frequency characteristics with twin peaks, and a special variable-step program has been designed for this computer. The results of such a numerical analysis are presented graphically and are illustrated by a typical example of a klystron multiplier operating at high power levels. Figures 4; references 3 (Russian).

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## MECHANISM FOR INCREASING THE EFFICIENCY IN A TRAVELING-WAVE TUBE BY TWO JUMPS OF THE PHASE VELOCITY AT APPRECIABLE VALUES OF THE SPACE-CHARGE PARAMETER

Kiev IZVESTIYA VUZOV: RADIOELEKTRONIKA in Russian Vol 20 No 3, Mar 77 pp 108-109 manuscript received 24 Nov 75

MALIVANCHUK, V. I., and RUKIN, V. P.

[Abstract] The gist of increasing the efficiency in a traveling-wave tube by two jumps of the phase velocity is that the first jump shifts the electron bunch forward from a point where the efficiency is still low to the retarding phase of the field and the second jump resynchronizes the wave with the beam. The calculated trajectories of electron bunches in a traveling-wave tube optimized for efficiency (35 percent) indicate that electrons which have passed the accelerating phase and bunched in the following phase of the field form a second bunch, while saturation in the tube at a farther point is due to formation of a third bunch which draws energy from the field. Figures 1; references 4: 3 Russian, 1 Western.

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