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ELECTRONICS AND ELECTRICAL ENGINEERING

No. 34

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ELECTRONICS AND ELECTRICAL ENGINEERING

No. 34

This serial publication contains abstracts of articles and news items from USSR and Eastern Europe scientific and technical journals on the specific subjects reflected in the table of contents.

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ELECTRICAL ENGINEERING

ELECTRONICS
Amplifiers

USSR UDC 621.375.121:621.382

DESIGN CALCULATIONS FOR EMITTER EQUALIZATION COMPONENTS IN STAGES WITH CAPACITIVE LOAD

Moscow ELEKTROSVYAZ' in Russian No 3, Mar 77 pp 54-58 manuscript received 27 Mar 75

BALANOV, A. T., VOLOSKOV, A. V., VOLOSKOVA, N. M., and IVANYUTIN, V. V.

[Abstract] A procedure is presented for selecting the components for emitter equalization of the frequency and transient response in wideband and pulsed transistor amplifier stages, where these drive a resistive load shunted by a capacitor. The procedure is worked out for the design cases most frequently encountered in practice. Figures 3; references: 6 Russian.

USSR UDC 621.396.67.001.5

ONE CRITERION OF THE SENSITIVITY OF RECEIVING ANTENNA SYSTEMS

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 22, No 7, Jul 77 pp 1374-1378 manuscript received 14 Jan 76

DIKIY, V. N., ZAYTSEV, E. F., and KONTOROVICH, M. I.

[Abstract] A study is made of a receiving system containing an antenna of arbitrary type and a receiver. The antenna is considered a linear device, although it may include nonmutual and active elements. The suitability of methods of comparison of various antennas according to their noise properties is discussed for the case when the antenna may include an amplifier. It is suggested that the noise quality of an antenna be evaluated using parameters independent of the directionality characteristics. Figures 2; references: 5 Russian.

USSR UDC 621.396.67.001.5

COUPLING BETWEEN ANTENNAS WITH RIBBED STRUCTURES

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 22, No 7, Jul 77 pp 1362-1373 manuscript received 28 May 76

KYURKCHAN, A. G.

[Abstract] The essence of the method of using ribbed structures to decrease coupling between antennas is that under certain conditions such a structure "squeezes out" the field from its surface, thus decreasing the quantity of energy reaching the receiving antenna. Apparently, the most adequate method for analysis of the operation of such structures is that based on strict formulation of the problem of a ribbed structure of finite length. This approach is used to analyze the two-dimensional problem of the coupling between antenna arrays with arbitrary amplitude-phase distribution and ribbed structures of finite length in the plane of the antenna apertures. The problem is reduced to an integral equation of the first kind for the distribution of the electric field in the apertures. A computational algorithm is investigated and results of computation are presented. The author thanks Ya. N. Fel'd for discussion of the work and helpful comments. Figures 8; tables 1; references: 6 Russian.

USSR UDC 621.386,67,012.12

THE PROBLEM OF OPTIMIZATION OF THE RADIATION PATTERNS OF ANTENNA ARRAYS CONSIDERING ADDITIONAL REQUIREMENTS

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 22, No 7, Jul 77, pp 1507-1509 manuscript received 8 Jul 75; after revision, 10 Dec 76

OBUKHOVETS, V. A., and SAZONOV, D. M.

[Abstract] A single calculation algorithm is presented, capable of making the transition from synthesis using the criterion of maximum efficiency with additional requirements in a number of directions to purely interpolation synthesis where M = N and further to synthesis on the basis of the criterion of mean-square approximation of M > N predetermined conditions for the behavior of the radiation pattern of the antenna array being synthesized. The transition is made by simply increasing the number of directions tested M. An equation derived in this report is useful for development of effective algorithms for controlling antenna arrays with moveable reception nulls for directions of arrival of intensive noise, and also is important in the proof of the convergence of the iterational process of suppression of side lobes in antenna arrays. References: 7 Russian.

USSR UDC 621.396.677

SELECTION OF THE NUMBER OF CONVERTORS IN A RECEIVING ANTENNA ARRAY WITH HIGH INTERFERENCE IMMUNITY

Kiev IZV- VUZ: RADIOELEKTRONIKA in Russian Vol 20, No 4, Apr 77 pp 83-87 manuscript received 25 Oct 76

VOLLERNER, N. F.

[Abstract] A study is made of the operations of nonsuperdirectional antenna arrays under the following conditions: The sensitivity of the system is limited by the internal noise of the devices connected to the output of the arrays, not by external, evenly distributed interference; the geometric dimensions of the arrays are limited, for example, by the interval of spatial correlation of the signals received or by technical and economic considerations, so that the arrays must output the maximum possible power in order to achieve high overall system interference stability. It is shown that in order to increase the energy extracted from the field, the number of elementary convertors must be increased over that necessary to eliminate additional main lobes. Rational limits to this increase in the number of convertors are indicated. Increasing the number of convertors also complicates the electronic scanning and feeder systems and ups the overall cost of the array. The expedient limit to the increase in the number of convertors is generally determined as a result of cost-benefit analysis encompassing the entire system. References: 3 Russian.

USSR UDC 62-504.2:517.91

ANBIGUOUS SLIDING MOTION IN RELAY SYSTEMS

Moscow AVTOMATIKA I TELEMEKHANIKA in Russian No 7, Jul 77 pp 45-61 manuscript received 3 Jun 76

SULTANOV, I. A., Moscow

[Abstract] A third-order relay system is considered which in addition to a linear system with constant coefficients, includes $r \geq 2$ discontinuity elements switched simultaneously in one break plane. The sliding of contacts occurs within a zone and, accordingly, the corresponding system of differential equations of motion has a "bundle" of solutions originating at some initial point within this zone. The problem is formulated here as a variational one with a free end and solved by the method of sections. The object is to determine the cones of allowable phase velocities and the optimal trajectories, which is done at first in the case where the matrix of constant coefficients of the reduced linear part of the system has real eigenvalues. The results are then extended to the more general case where the matrix of the constant coefficients of the original linear part of the system has complex eigenvalues. The analysis is also applied to a simple example of a relay system with r= 2 contacts, for which the boundaries of the sliding zone as well as the maximum-optimal and the minimum-optimal trajectories are found. The problem is solved both graphically and numerically. Figures 5; references: 7 Russian.

USSR UDC 621.374.32.037.372

A SMALL COUNTER WITH A CAPACITY OF 10^5 PULSES

Moscow RADIOTEKHNIKA in Russian Vol 32, No 7, Jul 77 pp 102-103 manuscript received after completion, 10 Jul 76

SAPRONOV, N. S.

[Abstract] The use of microcircuits has made it possible to minimize the size and improve the reliability of high-capacity (10^5 pulses or more) counters constituting a conventional decade-decoder-display system. Dynamic operating techniques such as sequential interrogation of the decade tracks through a distributor and transmission of stored data through a common decoder to the corresponding display cell allow a further reduction of the number of elements. A distributor has been developed on the basis of a ring counter, with a logic which precludes the loss of a 1 or a spurious addition of a 1. The decoder has inverting inputs. Standard components are used in all stages. A single unit together with the display is 60x60x100 mm large. Figures 1; references: 4 Russian.

USSR UDC 621.398.6

GRAPHS AND SYNTHESIS OF ENCODERS AND DECODERS FOR REMOTE CONTROL

Moscow AVTOMATIKA I TELEMEKHANIKA in Russian No 7, Jul 77 pp 152-162 manuscript received 29 Jun 76

KEPLER, F. E., Leningrad

[Abstract] Microelectronics and, particularly, integrated-circuit technology have made it feasible to build a new class of devices which inherently combines the function of an encoder or a decoder with those of a code converter (corrector), a distributor, a memory, and a counter. Such devices are useful for series, parallel-series, and parallel transmission of nonredundant or redundant codes. For the purpose of synthesizing such devices, the concept of tree graphs is appropriately extended. The properties of such generalized tree graphs are formulated in two theorems with a lemma following each, applicable to encoding and decoding respectively. The proofs to these theorems are also given. Figures 5; references: 1 Russian; 3 Western.

USSR UDC 681.327.67

AN OPTOELECTRONIC LOGIC ELEMENT

Leningrad IZV-VUZ:PRIBOROSTROYENIYE in Russian Vol 20, No 6, 1977 pp 108-110

BEREZYUK, N. T., and SVISHCH, V. M., Khar'kov Aviation Institute

[Abstract] An optoelectronic device to be used as a logic element is described. The device employs controlled mirrors to direct the light beam from a light source to produce a unit with several outputs. The mirrors are rotated by means of piezoelectric transducers. The use of controlled mirrors for the sequential deflection of the light beam substantially expands the logic options of these optoelectronic elements; the application of piezoelectric transducers for the control of the mirrors, and dispensing with a controlled light source permit an increase in the operational speed of the logic element. This paper is recommended by the Department of Computing Techniques. Figures 1; references: 3 Russian.

USSR UDC 621.395.623.7

DEVELOPMENT OF A STANDARD LOUDSPEAKER FOR MONITORING CHANNELS

Moscow TEKHNIKA KINO I TELEVIDENIYA in Russian No 7, 1977 pp 34-37

BOLDAREVA, O. A., VINOGRADOVA, E. L., SALTYKOV, O. A., and KHRABAN, I. A., All-Union Scientific Research Motion Picture Photography Institute

[Abstract] This paper deals with the development background and history, structure, and characteristics of a new loudspeaker system for use in a new set of film studio sound reproduction equipment. Speakers designed for this purpose must meet the paradoxical requirements of high quality reproduction, for monitoring soundtracks, detecting flaws, and rerecording, and of maintaining the characteristics of speakers used in motion picture theaters, to give an accurate idea of how the soundtrack will sound under these conditions. The new speaker system, the "Etalon," was designed for incorporation in the new "Zvuk TS" studio sound reproduction system. The "Etalon" is a three-way system with cutoff frequencies of 800 and 2000 Hz. The midrange component is a model 4A-32 direct radiator, the type used in motion picture theaters. The woofer, a model 2A-14M, and the midrange are enclosed in the speaker cabinet. The high-frequency component consists of two model 1A-22 horn-type tweeters mounted on top of the cabinet, unenclosed. Overall height of the system is 1330 mm. The cabinet is divided in two, internally, the top half housing the midrange in its own enclosure and the crossover network, and the bottom the separately enclosed woofer. Calculations used in designing this system are given for all components. Frequency characteristics are given. This system has an effective frequency range of 31.5 to 16,000 Hz. Even radiation only begins to be adversely affected at 8000 Hz. Recommended amplifier power: 12 to 50 W. Response: 31.5 to 16,000 Hz, $\pm$ 3 to 6 dB. Sensitivity characteristic: 0.9 Pa $\cdot$ $W^{-1/2}$. Nonlinear distortion at 12W no greater than 33 dB. Dimensions: 1330 X X 610 X 430 mm. Weight: 80 kg. This new speaker system received high ratings by experts, and it is recommended that it replace the 30A-96 system now used in film studio testing rooms and film copying studios. Figures 5; references 6: 2 Russian, 4 Western.

USSR UDC 621.397.13.037.372

NARROWING THE FREQUENCY BAND OF DIGITAL TV SIGNALS

Moscow TEKHNIKA KINO I TELEVIDENIYA in Russian No 7, 1977 pp 45-47

DUKHOVNER, A. N., Northwest Correspondence Polytechnical Institute

[Abstract] The creation of digital TV systems has brought urgency to the task of developing a technic for transmitting images with preliminary signal coding. Any coding of signals for digitizing continuous messages enlarges the frequency band necessary, especially with a great number of gradations.

It is possible to reduce the required frequency band for digital TV signals by statistical compression, thus eliminating redundancy in the image signal, or by hybrid coding, whereby simultaneous use is made of alterations in two or more pulse parameters. This paper explains a method of narrowing the required frequency band which is based on matching the spectral density of the signal with the narrowest frequency band (quasi-optimal filtration), using hybrid coding. Various code combinations making this possible are analyzed. It is shown that it is impossible to match the narrowest frequency band with binary coding. Nor is this possible with all hybrid codes. Practical considerations of circuit design making implementations of coding systems possible are touched upon. One hybrid code taken from an earlier paper reduces the number of pulse height gradations to a practically feasible amount, but quasi-optimal filtration using this code can not be carried out in practice, for the shape of each of the pulse sections must approach squareness, which can only be achieved by widening the frequency band. The AIM-VIM [pulse amplitude modulation, pulse time modulation] hybrid code fulfills all the necessary conditions for matching with the narrowest frequency band. The code combination shown here makes it possible to use 128 combinations (brightness gradations) with a required frequency band of 8 MHz, and to achieve feasibility of quasi-optimal filtration. It is concluded that quasi-optimal filtration of this sort makes it possible to narrow considerably the required frequency band of digital TV systems. Figures 4; references: 8 Russian.

USSR UDC 681.84.083.8.087.4

CORRECTING FREQUENCY CHARACTERISTICS IN MAGNETIC RECORDING SYSTEMS

Moscow TEKHNIKA KINO I TELEVIDENIYA in Russian No 7, 1977 pp 60-66

KOROLEV, YE. F., Moscow Power Engineering Institute

[Abstract] The frequency characteristics of magnetic disk recording systems show considerable distortion, much like aperture distortion in TV, because the influence of specific factors inherent in magnetic recording, and of recording losses and losses of different types, such as wave and frequency losses associated with recording and playback. It is necessary to correct this distortion when recording and playing back wideband signals. This paper deals with questions relating to correcting a direct magnetic disk record and playback channel, because this system is widely used in TV for recording pilot signals for monitoring and the high-frequency segment of the TV signal spectrum, as well as for accurate magnetic recording in various correlation tracking systems for wideband signals. The purpose of this paper is to estimate the degree to which correlation of the frequency characteristic of this type of channel is feasible. Correction of a record and playback channel is feasible in a transmission band in which the power of the intrinsic noise at the channel's output does not exceed the power of the input noise arriving from the source together with

the signal. Reducing the level of the channel's intrinsic noise and the level of contact losses makes it possible to correct the channel's amplitude-frequency response over a wider frequency range without worsening the ratio between the signal and the total noise at the channel's output. Additional widening of the transmission band by correcting the magnetic recording channel can be accomplished by reducing the level of contact losses and non-contact losses. These measures make it possible in the specific case described to widen the transmission band by no less than a factor of two. Simple formulas are given which make it possible to estimate the limits to which it is possible to widen the transmission band of a magnetic recording channel by correcting its amplitude-frequency response for various arbitrary signal-to-input-noise ratios. It is demonstrated that it is possible to achieve optimal correction of the magnetic record and playback channels of various correlation tracking systems. In an example given here optimum correction is achieved by equating the power of the input noise and the power of the record and playback channel's intrinsic noise. The validity of the calculated results obtained was checked experimentally, using a correlation tracking unit and a magnetic disk time delay unit for radio-interferometer signals. The experimental circuit utilizes optimal correctors consisting of video amplifiers with networks connected to their input which consist of series-connected high-frequency chokes and resistors. A circuit diagram is shown for a single module of this type of corrector. Greater correction is achieved by adding more of these modules in series. The "power" criterion introduced in this paper makes it possible to estimate the feasible range of correction for the amplitude-frequency response of a direct record and playback channel when recording wideband signals with a signal-to-noise ratio smaller than unity. Optimum correction of this response for correlation tracking systems can be achieved by ensuring an optimum signal-to-noise ratio at the correlator's output. Figures 9; references: 20 Russian.

USSR

A SIDEBAND ANALYZER FOR TELEVISION TRANSMITTERS

Moscow VESTNIK SVYAZI in Russian No 5, May 77 pp 25-26

PLATONOV, V. I., Senior engineer, Magadan Radio-Television Transmitting Center

[Abstract] Addition of a special-purpose transistorized receiver to the model Kh1-10 instrument for plotting the frequency characteristics of television transmitter equipment will make this instrument also useful as a sideband analyzer for 1 to 5 channels and thus save some amount of the test equipment required in a station. This receiver consists of a mixer and an i-f amplifier, and it is tuned to a frequency of 15 MHz. The two transistors are each loaded with an LC-circuit, one of the capacitances also serving as h-f smoothing filter. The weak coupling between both stages ensures a sufficiently narrow passband. The tuned amplifier stage also includes a diode-capacitor peak detector with a time constant much shorter than the sweep period of the Kh1-10 instrument, so that even the steepest transitions along sideband characteristics can be recorded. Figures 1.

USSR UDC 519.217

THE APPLICATION OF DYNAMIC PROGRAMMING TO CONTROL OPTIMIZATION IN CHANNEL SWITCHING NETWORKS

Moscow TEKHNICHESKAYA KIBERNETIKA in Russian No 3, 1977 pp 132-140 manuscript received 22 Oct 75

LAZAREV, V. G., and STAROBINETS, S. M., Moscow

[Abstract] An algorithm is derived for the control of traffic in a switched communications network, given the following assumptions: the information delay occasioned by the control unit realizing the traffic service algorithm, which cannot have complete information on the network status at a given point in time because of the finite speed of the data transmission equipment and the design of the control unit itself, is neglected; complete network status information is available; the network structure does not change; all network channels and switches are absolutely reliable, and the load on the network is of a Poisson character with a constant rate. The problem of finding the traffic control algorithm for this network which minimizes the losses per unit time is solved. The solution procedure is applied to the network handling n independent Poisson traffic flows, while the traffic control time is distributed in accordance with an exponential law; the problem is reduced to one of dynamic programming. Two algorithms are presented and the results of statistical modelling of the above network with five nodes are discussed. Figures 1; tables 1; references 7: 6 Russian, 1 Western.

USSR UDC 62-50:519.24

TWO-STAGE SIGNAL SEARCH IN A MULTICHANNEL SYSTEM WITH GROUPING AND ORDERING OF THE CHANNELS

Moscow TEKHNICHESKAYA KIBERNETIKA in Russian No 3, 1977 pp 156-164 manuscript received 3 Feb 75; after completion, 11 Oct 76

TERPUGOV, A. F., and SHAPIRO, F. A.

[Abstract] The article studies a two-stage signal search algorithm for channels which are grouped and ordered. It is presupposed that the characteristic of a group is the sum of the logarithms of the ratios of the probabilities of signal appearance in each channel. All N channels of the system are broken down into N/n of these groups of n channels each. In the two-stage procedure, the group with the signal is sought first; then, after this group is found, the channel with the signal in the group is sought. This curtails memory volume by n times. With an increase in n, the time for detecting the channel with the signal increases monotonically because of the prevailing influence of the decrease in the signal to noise ratio with this increase in the number of channel groups. When $N >> 10^3$, the increase

in the detection time caused by the combining of the channels in groups is small, and amounts to 5.7 percent when n = 10 and N = 10^3. Channel grouping, therefore, yields a considerable gain in memory volume and does not at the same time result in substantial losses in detection time. Supplemental control of the energy in the final scanning stage makes it possible to decrease the average detection time by 27-30 percent. Figures 4; references 8: 7 Russian, 1 Western.

USSR UDC 62-50.001:621.396

ADAPTATION IN RADIOTECHNICAL SYSTEMS

Moscow PRIBORY I SISTEM UPRAVLENIYA in Russian No 2, 1977 pp 5-7

ROMANOV, V. I., Candidate in Technical Sciences

[Abstract] One principal characteristic of the noise experienced by a radio signal-carrier is its nonstationary nature (as distinct from that of basic, or internal, noise); this results from medium-signal and signal-medium interaction. A second and equally important characteristic is the element of a priori indeterminacy, produced mainly by the difficulty of predicting the state of the medium.

The classical statistical theories (statistical theory of communication, etc.) have been fully worked out with respect to noise in the form of stationary random processes, and serve adequately in solving problems in that area. This is not true of nonstationary noise, where with few exceptions the classical theories cannot be applied with satisfactory results, because a nonstationary random process cannot be fully described by a single distribution law, while exclusion of the nonstationary character by dual averaging for an infinite interval entails too great losses.

Two new possible approaches to the creation of adaptive radiotechnical systems are suggested, based on the use of various statistical theories: 1) adaptation based on the theory of estimates; this consists basically in finding the optimal estimate of an unknown parameter α, and in selecting the optimal procedure $\lambda(\alpha)$; and 2) adaptation on the basis of recognition theory, aimed at recognizing classes of noise from spectral width, duration, etc., and, in some cases, from additional information obtained with the use of autonomous facilities. Figures 5; references: 3 Russian.

USSR UDC 621.372.6

"TRANSMISSION BRACKETS" - A METHOD OF NETWORK ANALYSIS AND SYNTHESIS

Moscow RADIOTEKHNIKA in Russian Vol 32, No 7, Jul 77 pp 21-26 manuscript received 20 Dec 75

OZOLIN'SH, A. E.

[Abstract] A method is proposed for designing nonreciprocal ladder networks containing irreversible converters and dependent sources. This method is based on a new concept of "transmission brackets" and applies to a quadripole where a converter $N_{k,k+1}$ has been connected between each two passive elements Z and Y. Each such converter has a forward transmission coefficient $B_{k,k+1}$ and a backward transmission coefficient $B_{k+1,k}$; and the physical significance (voltage, current, impedance, or admittance ratio) depends on the elements on both sides of a given converter. Kirchhoff's laws are applied to a network element containing three converters and the resulting matrix equation, in operator form, is then appropriately explicated. This method simplifies the symbolic notation, applies also the mechanical (acoustic) or hybrid networks, and facilitates calculations especially where the network structure becomes formidable. Figures 2; references 10: 8 Russian; 2 Western.

USSR UDC 621.372.55:621.397.231

A UNIFIED SYSTEM OF PASSIVE CORRECTORS FOR JUNCTION CIRCUITS

Moscow ELEKTROSVYAZ' inRussian No 6, Jun 77 pp 31-39 manuscript received 11 Feb 76

STRIZHEVSKIY, N. Z.

[Abstract] A method is proposed for matching available corrector circuits to individual junction circuits, without preliminary field tests and design changes, by controlling the characteristics (amplitude-frequency and group delay time) of bridged-T sections. This is achieved by means of a universal high-precision variable section and according to an appropriate tuning algorithm, with a minimum signal distortion. Such unified systems of passive video correctors are already available for coaxial junctions in television, multichannel telephone, and data transmission systems. Figures 8; references 18: 9 Russian, 3 German, 3 Western.

USSR UDC 621.376.2

ANALYSIS OF AM-TO-FM CONVERSION ON ARBITRARY NONLINEAR ELEMENTS

Kiev IZV. VUZ:RADIOELEKTRONIKA in Russian Vol 20, No 5, May 77 pp 51-56
manuscript received 12 Dec 76; after revision, 16 Mar 76

MALYSHEV, V. A. and CHERVYAKOV, G. G.

[Abstract] The problem of AM-to-FM conversion can be solved analytically with sufficient accuracy for elements with arbitrary voltage-current and voltage-charge characteristics, if these characteristics can be described by arbitrary analytical functions which satisfy the Dirichlet condition. The present analysis, based on the parallel equivalent circuit diagram with admittances, yields relations which indicate that no conversion can occur in a circuit without reactive elements, but with detuned components inserted it will occur even in the case of purely resistive nonlinear elements. The conversion factor increases with a higher envelope frequency, a larger amplitude of the applied voltage, and larger second derivatives of those characteristics. The conversion factor drops toward zero in the case of nonlinear elements whose characteristics are symmetric with respect to the applied voltage and whose operating point has been selected at the center of symmetry. Figures 2; references 7: 5 Russian, 2 Western.

USSR UDC 621.391

METHOD OF STABILIZATION OF THE PROBABILITY OF A FALSE ALARM IN SYSTEMS WITH PARTIAL COHERENT FILTRATION, WITH SUBSEQUENT NONCOHERENT ADDITION

Kiev, IZV.VUZ:RADIOELEKTRONIKA in Russian Vol 20, No 4, Apr 77 pp 112-113
manuscript received 9 Apr 76; after revision, 13 Aug 76

GRINYAYEV, A. O., KOSHEVOY, V. M., and TSYGANOV, O. V.

[Abstract] In systems with partial coherent filtration and subsequent noncoherent addition, the formation of a threshold level on the basis of the correlation matrix of noise involves significant difficulties related to measurement. The possibility is studied of forming a threshold on the basis of the first moments of the process at the input of the decision device. A method of formation of the threshold level based on expansion of the initial distribution function into a Laguerre series is studied. The approximation derived is correct for a broad range of values of false alarm probabilities (10^{-1}–10^{-8}) and number of pulses in a word (4-100) with arbitrary forms of the spectrum of fluctuations of passive noise. Figures 2; references 2: 1 Russian, 1 Western.

USSR UDC 621.391.1:519.2

TRANSMISSION CAPACITY OF PARALLEL BROADCAST CHANNELS WITH DEGRADING COMPONENTS

Moscow PROBLEMY PEREDACHI INFORMATSII in Russian Vol 13, No 2, Apr-Jun 77
pp 23-35 manuscript received 27 Sep 76

POLTYREV, G. SH.

[Abstract] A broadcast channel is considered which consists of two independent parallel components with a common input, each feeding into a separate receiver and each degrading in service. Of interest is the case where both components degrade in different directions. The limit of channel capacity with respect to separate information transmission only is calculated on the basis of two coding theorems and a lemma, the proof of the latter also given here. The limit of channel capacity is then calculated with respect to separate as well as common information transmission, for which two more lemmas and three additional theorems are proved. Figures 1; references 7: 3 Russian, 4 Western.

USSR UDC 621.391.1:519.27

OPTIMAL IDENTIFICATION OF JUMP COMPONENTS IN A MARKOV SIGNAL

Moscow PROBLEMY PEREDACHI INFORMATSII in Russian Vol 13, No 2, Apr-Jun 77
pp 45-54 manuscript received 23 Jun 75

DEMIN, N. S.

[Abstract] Into a continuous communication channel a signal enters whose one component, generally a vector, is a random Markov process with a discrete set of states and a continuous time, the other component being a diffuse Markov process. The problem is to decide, from measurements of the observable signal over some time interval, the kind of jump component which had entered the channel. The sufficient statistics for appropriate decision rules are established on the basis of three theorems relevant to hypothesis testing in this case. The results are further applied to the problem of suboptimal identification and to the problem of estimation. References 10: 9 Russian, 1 Western.

USSR UDC 621.391.1:519.28

FEASIBILITY OF DETECTING RANDOM TRAJECTORIES

Moscow PROBLEMY PEREDACHI INFORMATSII in Russian Vol 13, No 2, Apr-Jun 77 pp 72-82 manuscript received 27 Oct 75

ZIGANGIROV, K. SH.

[Abstract] The feasibility of detecting random trajectories of particles or targets is analyzed, without restrictions on the complexity of the detector, which at a given instant of time must decide between two hypotheses (absence or presence of a signal source). The effect of the signal-to-noise ratio on the detectability is established in terms of a threshold above which the false-alarm probability and the missed-hit probability can be made to move simultaneously to zero with increasing time, and below which this is not possible. This threshold is estimated, namely its upper and lower limits are determined on the basis of respective existence theorems and by means of appropriate algorithms. The effect of the trajectory path is also considered, a simple trajectory path being defined here in terms of its probability in an m-dimensional space. A 4-step detection algorithm based on the concepts of sequential decoding is given, with comments on the problems of realizability and complexity. References 8: 5 Russian, 3 Western.

USSR UDC 621.391.2

OPTIMIZATION OF A RECEIVER FOR CONTINUOUS MESSAGES TRANSMITTED THROUGH AN ACTUAL COMMUNICATION CHANNEL USING PULSE-AMPLITUDE MODULATION

Kiev IZV.VUZ:RADIOELEKTRONIKA in Russian Vol 20, No 4, Apr 77 pp 88-91 manuscript received 8 Jul 76; after revision, 20 Oct 76

GALITSKAS, A. A.

[Abstract] The two problems of reduction of interference between characters and interpolation of continuous signals on the basis of discrete samples, though technically related, have always been separately solved. This article presents an analysis of the filtration of continuous messages represented by pulses as a single problem. This approach is most efficient in the construction of a receiver for a multichannel communications system with time-division multiplexing of channels. The problem is formulated for analysis within the framework of the theory of optimal linear filtration. Some problems involved in the synthesis of an optimal receiver are analyzed. The structure of the optimal receiver for an individual message is presented. The digital filter in it consists of a system with a feedback circuit consisting of two digital filters with quantization steps Δ and Δ/M. When it is necessary to filter all M messages simultaneously, the receiver must contain not one, but M parallel-connected strobing devices with filters at their outputs, with the strobe pulses synchronized with the pulses of each corresponding channel. Figures 1; references 6: 5 Russian, 1 Western.

USSR UDC 621.391.2

EXPERIMENTAL DETERMINATION OF STATISTICAL CHARACTERISTICS OF THE COINCIDENCES OF RANDOM PROCESS EXCURSIONS

Kiev IZV. VUZ:RADIOELEKTRONIKA in Russian Vol 20, No 4, Apr 77 pp 21-28
manuscript received 19 Oct 76

OLEYNIK, N. G., MOKROUSOV, V. A., and ZHUKOV, V. P.

[Abstract] The method of digital simulation was used to study the statistical characteristics of the coincidences of excursions of independent normal stable processes with zero means and two types of correlation functions at the zero level. The correlation functions used were $K_1(\tau) = \sigma^2 \exp(-\alpha^2\tau^2/2)$ and $K_2(\tau) = \sigma^2 \exp(-\alpha^2\tau^2/2) \cos \omega_0\tau$, and their sums with the harmonic signal $s(\tau) = A \sin \omega\tau$. Coincidence of excursions of random processes refer to those cases when the random processes $\xi_i(\tau)$ simultaneously exceed the zero level, moving from the bottom upward. The experimental analysis of statistical characteristics of the duration and number of coincidences of excursions of independent normal stable processes and their sums with harmonic signals allows the correctness of the approximate calculations of these characteristics presented in earlier articles to be estimated, and in those places where the claculation is not possible, allows the behavior of the statistical characteristics of the coincidences to be clarified as a function of the various parameters of the signal and noise. Figures 4; tables 4; references: 6 Russian.

USSR UDC 621.391.2

RANK DETECTION OF A PULSE SIGNAL SUBMERGED IN NOISE AND RANDOM PULSE INTERFERENCE

Kiev IZV.VUZ:RADIOELEKTRONIKA in Russian Vol 20, No 5, May 77 pp 68-74
manuscript received 6 May 76

AKIMOV, P. S., and KUBASOV, A. N.

[Abstract] The rank method of detecting pulse signals is applied to the case of background noise plus random pulse interference. The duration of interference is assumed to be comparable with the signal duration and the probability of two or more signal pulses on the decision interval is assumed to be much lower than the probability of interference on this interval. The intensity of interference is close to the capacity of a soft receiver and much higher than the intensity of the useful signal as well as the dispersion of the Gaussian noise. The detection characteristics are calculated on the basis of the Neumann-Pearson criterion, for various lengths of the decision interval and with two different values of the false-alarm probability

(10^{-3} and 10^{-5}), assuming a Rayleigh distribution of the noise envelope, a Rice distribution of the signal + noise mixture, and a Rayleigh distribution of the fluctuating signal + noise mixture. The results refer to the lower estimate of detection probability. Figures 3; appendices 2; references: 2 Russian.

USSR UDC 621.391.2

CORRELATION RECEPTION OF MATCHED CODES

Kiev RADIOELEKTRONIKA in Russian Vol 20, No 4, Apr 77 pp 41-45 manuscript received 22 Dec 75; after revision, 11 May 76

IPATOV, B. P. and KORNIYEVSKIY, V. I.

[Abstract] Radio signals with complex envelopes in the form of binary periodic sequences are widely used for purposes of measurement of cosmic distances. Measurement of distances over a broad interval with high accuracy requires the use of sequences with a large number of characters (10^3-10^6). The construction of digital matched filters for such signals is difficult. However, correlation methods of signal processing are quite possible in such cases. In developing the hardware for such systems, the synchronization signal should be selected on the basis of the number of correlators which most of the users of the electronic system will have; however, it should be possible for the synchronization signal to be processed without great time loss by users with less expensive apparatus, which contains but one correlator in the processing device. It is also interesting to estimate the time loss for users with varying numbers of correlators. For this purpose, this article presents an estimate of the matched code processing time by devices containing various numbers of correlators. It is found that the time of optimal processing of matched signals is practically independent of the number of characters per period of each matched signal component; that the matched signal processing time for a single-channel receiver is less, the fewer the number of characters per period of each matched signal component; and that for large numbers of characters, as the length of the period of a component increases, the increase in the matched signal processing time by a single-channel device is more rapid than the decrease in matched signal processing time by a multichannel receiver. The number of characters per matched signal component period should therefore be selected as relatively small, such as seven or fifteen. Figures 1; references: 4 Russian.

USSR UDC 621.391.8

ASYMPTOTIC AND APPROXIMATE FORMULAS FOR POTENTIAL INTERFERENCE STABILITY OF ORTHOGONAL SIGNALS

Kiev IZV. VUZ:RADIOELEKTRONIKA in Russian Vol 20, No 4, Apr 77 pp 16-20
manuscript received 19 Apr 76

GUTKIN, L. S.

[Abstract] When one of m equally probable orthogonal signals with identical energy must be received against a background of additive white noise, the potential interference stability, i.e., the probability of error, can be calculated by the simple formula

$$\frac{Q}{N_0} = 2 \ln \frac{1}{P_{er}} + \ln (t - 1) - 2.8,$$

the error of which where $P_{er} \leq 0.1$ is not over 1 dB in the worst case; the formula is precise in the asymptotic cases. This formula is used to produce simple equations for estimation of the throughput capacity of a channel with orthogonal or optimal signals and conditions of achievement of permissible loss in required signal energy, in comparison with the minimum achievable value of this energy. Figures 1; references 6: 5 Russian; 1 Western.

USSR UDC 621.391.8

ADAPTIVE PANORAMIC RECEIVER WITH CONSTANT LEVEL OF FALSE ALARMS

Kiev IZV. VUZ:RADIOELEKTRONIKA in Russian Vol 20, No 4, Apr 77 pp 113-116
manuscript received 15 Mar 76; after revision, 11 Oct 76

DYATLOV, A. P.

[Abstract] Panoramic receivers are used during the stage of primary processing for collection of information on the parameters of signals. Because of the insufficiency of a priori information, they operate with an algorithm of noncoherent detection. Assuming a quasi-deterministic pulse signal with unknown amplitude constant over the observation interval, unknown moment of appearance of the signal, and Gaussian noise with random intensity, the author applies adaptive algorithms with an additional known learning sample (stimulating signal) to improve the quality of reception. The receiver studied is not only a noncoherent detector, but also measures the mean frequency of signals on the basis of time of appearance of signals at the output of the panoramic receiver. References: 5 Russian.

USSR UDC 621.391.14:519.2

SPECTRAL-STATISTICAL METHOD OF SIGNAL IDENTIFICATION

Kiev IZV. VUZ:RADIOELEKTRONIKA in Russian Vol 20, No 5, May 77 pp 99-101
manuscript received 9 Mar 76; after revision, 11 Aug 76

OMEL'CHENKO, V. A., and MATEVITSKIY, YE. O.

[Abstract] Automatic sampling of signal identification parameters is considered with the aid of a signal spectrum analyzer. The latter measures the primary indicators, namely the spectral components of a signal, and from these a much smaller number of secondary indicators is then formed for direct use in identification. This process is analyzed here and the decision rule is given. In the case of an à priori indeterminacy, identification is preceded by an adaptation or self-adaptation process. Results of typical experiments are shown, to demonstrate the feasibility of identifying telegraph signals by this method. Tables 1; references: 4 Russian.

USSR UDC 621.391.278

PROOF OF VALIDITY OF A CERTAIN METHOD OF MEASURING THE SIGNAL-TO-NOISE RATIO

Moscow RADIOTEKHNIKA in Russian Vol 32, No 7, Jul 77 pp 66-70 manuscript
received 11 Apr 75 revised 20 Sep 76

GINZBURG, V. V., GIRSHOV, V. S., and LESMAN, M. YA.

[Abstract] Various methods have been proposed earlier, on an intuitive basis, for measuring the parameters of a communication channel which transmits discrete data with phase-difference modulation. An instrument has also been designed which accepts decisions about the quality of such a channel (signal-to-noise ratio) on the basis of the average phase-difference deviations. The algorithm of this measurement ensures that the estimator of the given parameter will, under certain conditions, be asymptotically unbiased and in the case of not very small signal-to-noise ratios also asymptotically efficient. The validity of this method is proved here by calculating the likelihood function, on the premise that the given parameter remains virtually constant throughout n messages and that the additive noise may be regarded as white. The instrument can be used for operational quality control of communication systems as well as for adaptive reception of signals with redundancies. Figures 1; references: 7 Russian.

USSR UDC 621.381.822

SPECTRAL CHARACTERISTICS OF VLF CONTACT NOISE ACCOUNTING FOR METAL CREEP

Kiev IZV. VUZ:RADIOELEKTRONIKA in Russian Vol 20, No 5, May 77 pp 113-115
manuscript received 13 Oct 75; after revision, 5 Jul 76

EL'STING, O. G.

[Abstract] In contemporary radio equipment, random fluctuations of the contact resistance during current switching do not produce an f^{-a} ($1<a<2$) noise spectrum, unless changes in the resistivity occur between switchings. Such changes can be caused by metal oxidation or creep. Logarithmic creep and the effect of its rate on changes in the contact resistance are analyzed here, with the contact zone assumed to consist of microasperities whose volume remains constant but whose length varies logarithmically with time. The energy spectrum is defined accordingly, and has been evaluated by computer experiments for gold and platinum-iridium contacts. The result indicates that logarithmic creep under high pressure slowly reduces the contact resistance and causes the noise to become less white. Only under low pressure do fluctuations of the contact resistance produce an f^{-a} ($1.4<a<1.6$)noise. Figures 3; references 5: 3 Russian, 3 Western.

USSR UDC 621.391.832.2

CALCULATING THE LOW-FREQUENCY DISTORTIONS OF SIGNALS IN LINEAR QUADRIPOLES

Moscow RADIOTEKHNIKA in Russian Vol 32, No 7, Jul 77 pp 34-41 manuscript
received 3 Oct 75; after completion 11 Oct 76

VAYSBAND, M. D.

[Abstract] High-frequency and low-frequency signal distortions in wideband linear networks are usually treated separately, but the LF equivalent circuit is generally so unwieldy as to make an exact analysis very difficult and hardly worthwhile. Approximate methods of analysis are based on replacing the relevant dynamic characteristic with a power series. This approach is taken here and further developed for the specially important case of small distortions. A linear quadripole is considered which consists of several arbitrarily interconnected quadripoles and where the input signal can be either a single pulse or a periodic pulse train of arbitrary form. The transient response of such a network is expanded into a Maclaurin series in powers of the time variable. When the network is an ideal high-pass, then only a few first coefficients of this series need be known, the number of required coefficients decreasing together with the width of the input pulse or period of the pulse train. The distortion can be evaluated either from å priori information about the input signal or from measurements of the output signal. Figures 1; tables 1; references: 4 Russian.

USSR UDC 621.391.882.3.0015

DISPERSION AND CORRELATION FUNCTION OF THE NUMBER OF INTERSECTIONS OF THE THRESHOLDS OF A NARROW-BAND NORMAL NOISE ENVELOPE

Kiev IZV. VUZ:RADIOELEKTRONIKA in Russian Vol 20, No 4, Apr 77 pp 133-136 manuscript received 8 Jul 76

ROZHKOV, I. T., and CHIRKOVA, I. N.

[Abstract] The solution of a number of practical problems related to the processing of radio signals requires that we know the dispersion and correlation function of the number of times of intersection of the thresholds of the envelope of narrow-band normal noise. Considering that random process $\xi(t)$ is a narrow-band normal process with zero mean, an expression is derived for the dispersion of the number of positive intersections of constant level C in time interval T by the envelope of the stationary process $\xi(t)$. An expression is also derived for the correlation function of the number of positive crossings of the levels C_1 and C_2 by the envelope of process $\xi(t)$ during analysis time T. The dispersion of the number of intersections, ratio of mean square number of intersections to the mean correlation coefficient of the number of intersections as functions of thresholds, analysis time and effective frequency band of the receiver were calculated by numerical integration on an electronic computer. The results of the calculation indicate that the dispersion of the number of positive intersections and of the number of intersections increases with increasing analysis time and with increasing effective frequency band; the dispersion of the number of positive intersections on the relative threshold has a maximum which is higher, the greater the analysis time and the wider the effective frequency band; the ratio of the square root of the dispersion of the number of positive crossings to the number of crossings depends on the threshold and reaches its minimum where $C/\sigma \simeq 1$; as analysis time T_a increases and effective frequency band of the receiver increases, the ratio just mentioned decreases; the normalized correlation function of the number of crossings depends on the difference in thresholds and the level of readings of the difference of thresholds; as analysis time increases, the normalized correlation function increases, while as the frequency band increases the normalized correlation function decreases. Figures 3; references: 5 Russian.

USSR UDC 621.394.67

A CODE CONVERTER FOR INFORMATION TRANSMISSION ALONG COMMUNICATION CHANNELS

Moscow ELEKTROSVYAZ' in Russian No 6, Jun 77 pp 62-64 manuscript received 24 Jun 74

MANUKYAN, YU. S. and FILATOV, G. I.

[Abstract] A device has been developed which converts the binary-cyclic-decimal code, first to the binary-decimal code and then either to the 7-digit

(Government Standard 13502-67) or the 8-digit code for "information exchange" between a computer and peripheral equipment. The synthesis of this device is based on binary logic, with the conversion process described by a set of switching functions in a complete disjunctive normal form. Such a device has been built in the IC version on the basis of series-155 TTL. A high-level signal (2.4-4 V) corresponds to 1 and a low-level (0.4 V) signal corresponds to 0, the NAND function being realized when high potentials appear at the inputs. The operation of this code converter is illustrated here in the teletypewriter mode. It is suitable for linking the output stages of a multichannel retrieval system and for conversion of primary information prior to transmission of the latter over low-speed or medium-speed channels. Figures 1; tables 1; references: 5 Russian.

USSR

HOW TO RAISE THE EFFECTIVENESS OF SUPERVISION AND STAND-BY CONTROL EQUIPMENT STATIONS

Moscow VESTNIK SVYAZI in Russian No 5, May 77 pp 22-23

SHED'KO, V. M., Senior Project Engineer, NIIR [?Scientific-Research Institute of Radio], and ZELENSKIY, E. A., chief of industrial laboratory, Murmansk PTUS [expansion unknown]

[Abstract] Additional components for supervision and standby control equipment stations have been developed at the Murmansk industrial laboratory, with which it becomes possible automatically to supervise and control radio wire broadcasting stations in remote villages, where automatic telephone exchanges are not available, from a nearest central location. These components include a 2400-Hz oscillator, a set of relays, and appropriate pushbuttons. Figures 1.

USSR

IMPROVING THE UTILIZATION OF INSTALLED POWER

Moscow VESTNIK SVYAZI in Russian No 5, May 77 pp 27-28

SHAMANSKIY, G. N., Plant Laboratories of MEIS [Moscow Electrotechnical Institute of Communications], and POPOVA, O. I., Senior engineer

[Abstract] The problem of utilizing the installed power as soon as possible is of concern in automated long-distance telephone systems. Progress in terms of percent full level reached from year to year, in small-capacity systems (up to 500 channels) and in large-capacity systems (over 500 channels), is

compared with normal schedules. While progress has been satisfactory in the Kiyev system, in other cities there is a noticeable lag of up to 25 percent. This is explained by inherent difficulties in budgeting, engineering, and management as well as by incomplete and delayed deliveries.

USSR

IMPROVING THE METHODS OF INSTALLING COMMUNICATION CABLES

Moscow VESTNIK SVYAZI in Russian No 7, Jul 77 pp 29-31

MAKSIMOV, V. I., Chief engineer. Main Administration of Communication Equipment Construction, Ministry of Communication, USSR

[Abstract] The intensive growth of interurban, urban, and rural communication networks requires that all cable connections be of such a high quality as to ensure practically no strength and life degradation of cable sections throughout their span length. A major step forward has been a changeover from conductor-by-conductor to simultaneous pairwise splicing, with proper loop twisting and the use of common sleeves. A further step will be the introduction of multipair splicers and special-purpose splicers for coaxial cables in high-frequency channels. Another area of improvement is the joining of cable jackets. Here special techniques have been invented for welding polyethylene jackets, for pouring tar-varnish compound into the joint, and for soldering aluminum or corrugated steel jackets. Also noteworthy are the recently invented and most reliable methods of gluing and pressurized sheathing. All these techniques have already been tried and found reliable as well as economically feasible. Their suitability for various types of cables and their usefulness in permafrost regions of the country have yet to be established.

USSR

EFFECT OF DEVELOPMENTS IN INTERURBAN TELEPHONE COMMUNICATION ON THE NATIONAL ECONOMY

Moscow VESTNIK SVYAZI in Russian No 5, May 77 pp 28-30

GORELIK, M. A. and YEFIMOVA, I. B., Moscow Electrotechnical Institute of Communications

[Abstract] The economic effect of interurban telephone communication must first be qualitatively evaluated, before an acceleration of further developments in this area can be economically justified. On the basis of extensive

market research, normative indicators and certain criteria have been defined for measuring such an economic effect. The saving in time, the saving in personnel, the saving in production costs, and the increment of production output per 1000 interurban telephone conversations serve as indicators. These indicators are applied to three categories: industry, construction, and materials production. The respective values of these indicators serve as criteria with a quality factor included, for the base year 1975 and the target year 1980. This simple chart reveals a high overall economic effect of interurban telephone communication. It should be useful as a guide for further planning and budgeting. Tables 1.

USSR

NEW METHODS OF SPLICING CONDUCTORS OF MULTIPAIR CABLES IN URBAN TELEPHONE NETWORKS

Moscow VESTNIK SVYAZI in Russian No 7, Jul 77 pp 31-32

KOMAROV, O. M., and OVSYANNIKOV, A. I., engineers, SSKTB [Construction-Erection Organization and Specialized Design and Technological Bureau], Ministry of Communications, USSR

[Abstract] The development of multipair common-sleeve splicers has been a major step toward improving the quality of cable connections in urban telephone networks. The model PSZh-4 simultaneously twists and splices four pairs of conductors with polyethylene or paper insulation. The insulation is properly preheated and the conductors are electrically welded. The model SMZh-10 handles 10 pairs simultaneously, with mechanical or manual twisting and with proper stripping of the insulation before electrical contact is made. The model PSMZh-200 developed by SSKTB and series produced by workshops of the "Lentelefonstroy" Trust is essentially a lifting jack for splicing under pressure. Figures 3.

USSR

PROBLEMS IN ORGANIZING DISCRETE CHANNELS ALONG URBAN TELEPHONE NETWORK CABLES

Moscow VESTNIK SVYAZI in Russian No 5, May 77 p 19

SHVATSKIY, M. YA., senior engineer, Department of Telegraphy, Ministry of Communication, Ukrainian SSR

[Abstract] The ever increasing demand for telegraphic service calls for a development of both direct-connection and subscriber networks. The shortage

of cable pairs for discrete information transmission is particularly acute in large cities, where urban telephone networks operate and expand on a self-sufficiency basis and thus cannot provide adequate relief for telegraphic service. The problem has to a large extent been solved by multiplexing of telephone channels with the aid of the appropriate equipment (TVU-12, DATA, URAL, and AGAT) which ensures the availability of up to 12 channels. Most effective seems to be the 12-channel TVU-12 system installed in Kiev, which operates at high frequency and is capable of transmitting discrete information at the rate of 50, 100, and 200 bodes without limitation on code and synchronization. It is properly maintained and tested by the personnel of the Kiev Central Telegraph Office, being ready now to be handed over to local telephone subscriber offices.

USSR

UDC 621.395.74

SCIENTIFIC AND ENGINEERING PROBLEMS IN THE APPLICATION OF COMPUTERS TO SWITCHING

Moscow ELEKTROSVYAZ' in Russian No 6, Jun 77 pp 48-53 manuscript received 1 Dec 76

GUTIN, M. I.

[Abstract] An All-Union Scientific-Technical Symposium was held in Yerevan in 1976 on the application of computers to switching. This topic is of particular relevance to the development of quasi-electronic stations in automatic telephone networks. Computers are used here as special-purpose control devices, which involves many problems of both a scientific and technical nature in connection with the design, construction, and operation of such stations. General design problems are closely related to those of interfacing and programming, the effectiveness of their solution being measured by the service quality and reliability. The development of programmed control systems follows the same stages as that of any other new product (design, pilot production, serial production, on-line operation), each of them having its own special features and all of them somehow interlinked. Many items were not covered in this symposium such as data on the installation and the experimental evaluation of new switching stations, but this should be given proper attention at the next symposium scheduled for 1978. References 9: 7 Russian, 2 Western.

USSR UDC 621.395.341

MATCHING THE PCM-30 EQUIPMENT WITH URBAN AUTOMATIC TELEPHONE EXCHANGES

Moscow ELEKTROSVYAZ' in Russian No 6, Jun 77 pp 19-23 manuscript received 26 May 76

KOLBASOVA, V. I. and SOKOLOVA, V. S.

[Abstract] PCM equipment is installed in urban automatic telephone exchanges for multiplexing the dialing channels, where FM operation with one channel in each direction is technically disadvantageous and with two channels in each direction is not economically feasible. PCM operation with two channels in each direction has been found optimal in both respects, but requires matching equipment. This is illustrated here by a detailed analysis of all the steps taken in establishing a connection between two subscribers. Reliability, cost, and convenience have been considered in the design and the allocation of matching equipment. It is applicable to interurban automatic telephone exchanges as well. Figures 1; tables 2; references: 5 Russian.

USSR

HOW TO IMPROVE THE QUALITY OF TELEGRAM RECEPTION IN A DIRECT-CONNECTION NETWORK

Moscow VESTNIK SVYAZI in Russian No 5, May 77 pp 20-22

MUSHKAT, M. I., candidate in technical sciences, chief of a laboratory of the Order-of-Lenin Telegraph Exchange, Ministry of Communications, USSR

[Abstract] One of the greatest problems in direct-connection telegraph service are illegible messages. Laboratory research has produced the means of appreciably reducing the defectiveness of telegrams, namely reducing the probability of an illegible message by a factor of 920. This is achieved by checking the polarity of the stop signal for each character at the receiving end and feeding back an error to the transmitting end for immediate correction. The ZONA-S apparatus which performs this function is properly installed in the line, having been designed for high reliability and protected against noise, where it provides both a labor and cost saving device. Figures 3.

USSR UDC 654.14.004.15

INFORMATION PROCESSING TIME IN A GENERAL-PURPOSE TELEGRAPH NETWORK

Moscow ELEKTROSVYAZ' in Russian No 6, Jun 77 pp 54-57 manuscript received 12 May 76

GUBIN, N. M., MAYOFIS, L. I., and ABSUROVA, R. P.

[Abstract] According to the guidelines set by the 25th Communist Party Congress and the decree issued by its Central Committee on 22 November 74, the Ministry of Communications is developing a new differential master delivery schedule for both local and interurban telegrams. Unlike the old single master schedule, which allows five hours from sender to receiver, this new master schedule takes into account the type of telegram transmission system and its operating mode, the electrical communication equipment available at both ends, and the user category. It should improve the efficiency of the telegram service, with optimum utilization of night hours, and should considerably reduce the number of complaints. Figures 4; tables 1; references: 2 Russian.

USSR

A GENERAL-PURPOSE SIGNALIZATION PANEL FOR LINE-EQUIPMENT WORKSHOPS

Moscow VESTNIK SVYAZI in Russian No 5, May 77 pp 24-25

BERLIN, B. Z., Chief, Department of Multiplexing Equipment, Leningrad Urban Telephone Network, and MANDRUSOVA, YE. A., candidate in technical sciences, Leningrad Branch Scientific-Research Institute of Communications

[Abstract] A general-purpose signalization panel is proposed for use in line-equipment workshops which will pick up information about the most serious defects in any type of multiplexing equipment throughout an urban telephone network. Above all, such information includes defects causing an emergency or failure of more than 30 percent of all the channels in one direction between automatic telephone stations. For convenience, the signal lights are grouped according to the type of fault, with a certain color assigned to each group, and a certain letter code assigned to each signal in a group. Figures 2.

USSR UDC 621.395.741

DEVICES FOR BETTER SHIELDING BETWEEN HF TRANSMISSION SYSTEMS

Moscow ELEKTROSVYAZ' in Russian No 6, Jun 77 pp 24-31 manuscript received 29 Aug 75

GRIGOR'YEV, V. A., and KHVOSTOVITSKIY, YE. T.

[Abstract] Crosstalk is the dominant mode of interference along HF symmetric communication lines. In order to improve the shielding between channels, decouplers have been developed at the "Mezhgorsvyaz'stroy" (All-Union State Trust for the Construction of Long-Distance Wire Communications Structures), which operate on the principle of transformer-coupled bridge circuits. The decoupler components are designed, with the aid of a computer, on the basis of preliminary field measurements with an automatic complex-coupling meter. The decoupler assembly on a chassis becomes part of the overall equipment in an attended repeater station. Upon installation, the decoupler performance is checked with a compensating-measuring panel. The decoupler components can also be selected directly at the trunk line, from a set of interchangeable circuit components. All the necessary work is done without service interruption. Figures 11; references: 3 Russian.

USSR UDC 621.387.5

AN OPTICAL PULSE REPEATER BASED ON AN INJECTION LASER

Kiev IZV. VUZ:RADIOELEKTRONIKA in Russian Vol 20, No 5, May 77 pp 23-29 manuscript received 22 Dec 75; after revision, 15 Mar 76

LOGGINOV, A. S., POGONIN, V. I., and SOLOV'YEV, V. YE.

[Abstract] The feasibility of recovering the amplitude of optical pulses by means of a bistable injection laser is theoretically analyzed. Such a laser is nonuniformly excited along the p-n junction and is pumped from a Gunn-effect diode, which, together with a delay line in series, provides for automatic current cutoff. A family of power-current characteristics is calculated, with the ratio of passive-to-active laser volume as the parameter. The practical applicability of this concept is demonstrated in the case of an epitaxial GaAs laser with known physical characteristics. Here the gain increases with higher pumping current, but is limited by spontaneous emission. On the basis of rough empirical estimates, a maximum gain higher than 100 with a passive-to-active volume ratio higher than 0.1 seems possible. Figures 6; references 15: 6 Russian, 8 Western.

USSR UDC 621.391.63.029.7

STATISTICS OF RAYS IN MULTIMODE IRREGULAR OPTICAL FIBERS

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 22, No 7, Jul 77 pp 1496-1499 manuscript received 2 Mar 76

SHATROV, A. D.

[Abstract] A ray method is suggested for calculation of multimode statistics in irregular fiber light guides, allowing a comparatively simple study of smooth (in the scale of the wave length) irregularities in fibers of various types. A medium conducting a wave along the Z axis with indices of refraction N (x, y, z) is studied. The ray is characterized by its coordinates and "impulses," defined as a vector tangential to the trajectory of the ray, the numerical value of which is equal to n. A system of ordinary differential equations of Hamiltonian form is used to find the trajectory of a ray. The author thanks B. Z. Katsenelenbaum for interest in the work and is grateful to R. F. Matveyev for a number of critical remarks. References 10: 8 Russian, 2 Western.

USSR UDC 621.396.22.029.7

THE USE OF SEMICONDUCTOR TERMINAL DEVICES IN HIGH INFORMATION CAPACITY OPTICAL FIBER COMMUNICATION LINES

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 22, No 7, Jul 77 pp 1534-1537 manuscript received 6 Oct 76

BAZARNYY, YE. M., BORODULIN, V. I., GULYAYEV, YU. V., LISTVIN, V. N., POTAPOV, V. T., SOSNIN, V. P., STEL'MAKH, M. F., TREGUB, D. P., ELENKRIG, B. B. and SHVEYKIN, V. I.

[Abstract] The purpose of this work was the creation and investigation of a model fiber optical communication line with semiconductor terminal devices and a relay device allowing transmission of sequences of nanosecond pulses with a rise time of 0.5-1 nsec. The radiators used were semiconductor GaAs lasers radiating at a wave length of 0.86 μm, one of the loss minima in the glass fiber. The semiconductor optical relay device consisted of a photodetector, input amplifier, output amplifier, and laser. The sensitivity of the detector is 0.4 a/w with a reverse bias voltage of about 8 v. The input amplifier consisted of four amplifier sections made of bipolar microwave transistors with a current gain factor of 70. Study of the model transmission line was performed in the single pulse and pulse sequence modes, the sequences consisting of two pulses with adjustable time separation. Estimates made on the basis of the results produced indicate that the maximum information transmission rate in the line would be 400 Mbit/s. The authors thank M. Ye. Zhabotinskiy, V. V. Grigor'yants, and G. N. Ivanov for making glass fiber available. Figures 6; references 5: 4 Russian, 1 Western.

USSR UDC 621.396.43

GROUP DELAY TIME IN WAVEGUIDE CHANNELS OF RADIO RELAY TRUNKS

Moscow ELEKTROSVYAZ' in Russian No 6, Jun 77 pp 39-43 manuscript received 6 Oct 76

TARTAKOVSKIY, L. S.

[Abstract] The performance of the waveguide channels in radio relay trunks and thus the quality of the latter are affected by the nonuniformity of the group delay time. Here the nonuniformity of the group delay time caused by crosstalk is analyzed, the latter being regarded as resulting from reflections at plane waveguide inhomogeneities. A conventional waveguide channel and one with better reflection characteristics are compared on the basis of basic group delay time statistics, whereupon a relation is established between the group delay time nonuniformity and the mean crosstalk power. The author thanks S. V. Borodich and B. S. Nadenenko for valuable comments. Figures 6; references: 6 Russian.

USSR UDC 621.396:621.59

EVALUATION OF NOISE IMMUNITY OF PARAMETRON RECEPTION OF PHASE-MODULATED DISCRETE SIGNALS

Moscow RADIOTEKHNIKA in Russian Vol 32, No 7, Jul 77 pp 92-95 manuscript received after completion, 14 Sep 76

BURUNSUZYAN, E. S., and KHALPAKHCHYAN, S. G.

[Abstract] The noise immunity of parametrons for transmitting discrete signals is evaluated, taking into account the characteristics of super-regenerative operation. An additive mixture of signal and normal noise is assumed at the input, with parametric excitation effected by the component whose phase is most favorable. The probability of correct phase reading is calculated first for the case of single excitation and then for the case of multiple excitation. On the basis of an analysis involving the transient characteristics and various signal parameters, the sensitivity threshold is established as a function of, among others, the Q-factor and the discrimination factor. The results indicate that maximum sensitivity is attainable only with multiple excitation and that the Q-factor should be as high as possible. When the energy is carried by low-power long signals, then parametron receiver performs nearly as well as an optimal one. Figures 3; references 7: 6 Russian; 1 Western.

USSR UDC 621.396.96:621.391.26

DETECTION OF PULSE SIGNALS SUBMERGED IN A NORMAL BACKGROUND NOISE WITH UNKNOWN CORRELATION CHARACTERISTICS

Moscow RADIOTEKHNIKA in Russian Vol 32, No 7, Jul 77 pp 3-9 manuscript received 16 Aug 76

SHLOMA, A. M.

[Abstract] The synthesis of pulse-signal detectors is considered in the case of a background noise with unknown correlation characteristics. The particular concern here is not so much the intraperiodic processing (matched filtration) as the interperiodic processing (rejection, storage, weighing, etc.) of pulse signals, and technically feasible algorithms for this are sought. The problem is solved by application of Hotelling's (T^2-) statistics and treating the noise as a Markov process, first nonstationary correlated and then stationary correlated. The resulting detection algorithm is optimal with respect to a stable false-alarm probability and a minimum missed-hit probability. References 6: 3 Russian; 3 Western.

USSR UDC 621.396.23

ESTIMATE OF THE OVERALL EFFECTIVENESS OF COMMUNICATION SYSTEMS

Kiev IZV. VUZ:RADIOELEKTRONIKA in Russian Vol 20, No 4, Apr 77 pp 29-32 manuscript received 23 Feb 76; after revision, 24 Aug 76

KUZ'MIN, B. I., and YURLOV, F. F.

[Abstract] Combined analysis of the technical and economic characteristics of communication systems in order to determine the most effective methods of information transmission can be performed by determining the generalized characteristics of the system and comparing them with costs in each possible technical version. One such generalized characteristic is the quantity of information J which can be transmitted in time T with some preassigned minimum reproduction quality. In planning information transmission systems, the main tasks may be either the transmission of the necessary volume of information, assigned in advance, at minimum cost, or maximization of the volume of information transmitted with fixed cost. Factors influencing the effectiveness include technical parameters such as communication range, interference stability. transmission rate, hardware reliability, etc.; system functioning conditions, such as type of interference, climatic and temperature conditions, etc.; and system use plans, reflecting the various possibilities for utilization of communication systems. The use of cost-effectiveness diagrams is suggested for comparison of various possible versions of communication systems. A formula is developed for calculation of the reduction in error probability achieved by an increased system cost. Figures 4; references: 2 Russian.

USSR UDC 621.396.628

EFFECT OF THE PASSBAND WIDTH ON THE INFORMATION DISTORTION BY PULSE NOISE

Moscow ELEKTROSVYAZ' in Russian No 6, Jun 77 pp 72-77 manuscript received 3 Dec 74

KUZ'MIN, B. I.

[Abstract] It is proved here that the error probability in the reception of binary signals by gating depends on the passband width of discrete-type communication systems where pulse noise exists. The general analysis of frequency-modulation telegraphy is applied to various forms of resonance characteristics in the receiver channel. The results indicate that the type of resonant circuit largely determines the information distortion by powerful pulse noise, but does not effect the critical passband bandwidth at which this distortion is maximum. For the purpose of this analysis, the duration of the response to pulse noise is calculated for a single oscillatory circuit, for a system with a Gaussian frequency characteristic, for a system with a rectangular frequency characteristic, and for a resonant system with a matching filter in the receiver channel. Figures 5; tables 1; references: 6 Russian.

USSR UDC 621.319.4

CALCULATION OF THE PARTIAL CAPACITANCES OF THE EDGE AREA OF A PARALLEL-PLATE CAPACITOR WITH A GUARD RING

Novocherkassk IZV. VUZ:ELEKTROMEKHANIKA in Russian No 6, 1977 pp 628-636
manuscript received 24 Jan 75; after completion, 13 May 76

BALAKLEYEV, VIKTOR NIKOLAYEVICH, candidate in technical sciences and engineer, Novocherkassk Polytechnical Institute, and ZOLOTAREV, NIKOLAY ALEKSEYEVICH, candidate in technical sciences and Dotsent, Novocherkassk Polytechnical Institute

[Abstract] The problem studied in this paper is to determine the partial capacitances between three electrodes of an air capacitor with a guard ring at its edge, whereby the edge capacitance between the two plates is defined as the ratio of the electric induction flow going from the edge of the first plate to the second, to the voltage between them. An integral equation of the first type is derived by obtaining as its kernel a Green's function for the edge area of the parallel-plate capacitor. This is arrived at by considering the density of electric charges at the guard ring. Solution to this integral equation is found in the form of a linear combination of two functions which satisfy two respective equations, one of which makes it possible to find the distribution of the electric charge in the guard ring if its potential is equal to unity and the capacitor's plates are grounded. This equation is solved by using a linear combination of Chebyshev polynomials. The other equation describes the distribution of the charge in the guard ring when it is grounded and voltage is applied to the capacitor's plates. A system of linear algebraic equations is found. The partial capacitances of the guard ring are easily found by using the results of solving the integral equation above. The edge capacitance between the capacitor's plates is found in the same manner. An example is given of calculation of the distribution of charges in the guard ring. Finally, a discussion is given of the influence of the guard ring on the edge capacitance of a parallel-plate capacitor. The edge capacitance can be influenced by changing the width of the guard ring and its position at the edge of the capacitor. It is possible in this way to make the electric field between the capacitor's plates practically homogeneous. If the width of the guard ring is greater than one half of the distance between the capacitor's plates, the edge capacitance changes but slightly when this ring is displaced a considerable distance with respect to the edge of the top plate. Generally speaking, with a ring of this sort it is impossible to compute the capacitance of a parallel-plate capacitor without considering the disturbance of the homogeneity of the electric field at the edge of the top plate. Figures 6; references: 5 Russian.

USSR UDC 621.372.8

DISPERSION CHARACTERISTICS OF A RECTANGULAR WAVEGUIDE WITH RESISTIVE FILMS DEPOSITED ON A DIELECTRIC SUBSTRATE

Kiev IZV. VUZ:RADIOELEKTRONIKA in Russian Vol 20, No 5, May 77 pp 109-112
manuscript received 30 Dec 75; after revision, 15 Apr 76

KALMYK, V. A., MARKOVA, S. A., and RAYEVSKIY, S. B.

[Abstract] Waveguides with resistive films are used for filters and wideband microwave attenuators. The peculiarities of wave propagation in such waveguides are analyzed here in the case of a rectangular waveguide with a dielectric substrate located symmetrically at the center. The boundary conditions can generally only be satisfied by a hybrid mode, and the Hertz field vectors are written for each of the three regions accordingly. The condition of nontriviality for the resulting system of four linear algebraic equations in unknown amplitude factors then yields the dispersion equation. An evaluation of the dispersion characteristics indicates that the presence of a dielectric substrate has eliminated two-valued ranges and the dip. Figures 4; references 6: 5 Russian, 1 Western.

USSR UDC 621.372.826:621.213.61

ACOUSTIC-OPTICAL RAMAN-NATH INTERACTION IN FLAT WAVE GUIDES

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 22, No 7, Jul 77 pp 1355-1361
manuscript received 14 Apr 76

GUDZENKO, A. I., ZUBAREV, I. L. and KURDYUMOV, O. A.

[Abstract] The interaction of optical and acoustical surface waves is qualitatively similar to the well-known interaction of the corresponding 3-dimensional waves, but depends on a greater number of parameters and its analytic description is more complex. The purpose of the present work is a quantitative analysis of the Raman-Nath diffraction of optical surface waves in a flat asymmetrical dielectric wave guide by Rayleigh-type acoustical surface waves excited in a dielectric substrate, and the production of formulas suitable for practical calculations. The method of transverse cross sections, well developed for dielectric wave guides, was used in the analysis. The data produced are somewhat elevated in comparison with experimental results, which may be explained by the approximation made in solving the problem of propagation of the Rayleigh wave in the film-substrate system, which did not take completely into consideration the differences in photoelastic and isotropic properties of the materials of the substrate and the film. Nevertheless, the method does yield qualitatively correct physical results which can be refined in the future and permits an estimate of

the acoustical power necessary for the operation of actual acoustic-optical devices. The authors thank L. N. Derugin for constant interest in the work and a number of valuable comments. Figures 1; tables 1; references: 9 Russian.

USSR UDC 621.372.826:621.315.61

BILATERAL CONDITIONS ON THE WALLS OF GAS-DIELECTRIC WAVE GUIDES

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 22, No 7, Jul 77 pp 1493-1496 manuscript received 30 Mar 76

POPOV, A. V., UFIMTSEV, P. YA., and KHARLASHKIN, O. A.

[Abstract] Bilateral conditions are formulated for a wave guide model useful in numerical solution of field equations, because they allow the dimensions of the area of integration to be reduced. Using the example of a flat irregular wave guide, for which a strict solution exists, the boundaries of applicability of the conditions in question are established. The authors thank B. Z. Katsenelenbaum, Ye. I. Nefëdov and A. N. Sivov for discussion of the work. Figures 2; references: 6 Russian.

USSR UDC 621.372.8.049.75

DETERMINATION OF NATURAL WAVES IN STRIP LINES CONSIDERING THE THICKNESS OF THE CONDUCTORS

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 22, No 7, Jul 77 pp 1331-1340 manuscript received 23 Jul 76

NIKOL'SKIY, V. V., and DRUZHININ, A. V.

[Abstract] A method is suggested for construction of algorithms for investigation of the spectrum of the natural waves in various strip lines, considering the thickness of the conductors. The regular lines studied include an ordinary strip line, its slit analogue, as well as various more complex cases including a "suspended substrate" version which can include a slit line, coplanar line, etc. The method is based on separation of subareas, introduction of Trefts bases and construction of integral equations. The algorithm was run for a line with a flat conductor located in the center using a FORTRAN program and a BESM-6 computer. Figures 8; references 8: 3 Russian, 5 Western.

USSR UDC 621.372.832

APPROXIMATE SYNTHESIS OF DIRECTIONAL COUPLERS ON NONHOMOGENEOUS COUPLED LINES

Moscow RADIOTEKHNIKA in Russian Vol 32, No 7, Jul 77 pp 51-56 manuscript received 12 Dec 75

REYZENKIND, YA. A.

[Abstract] Directional couplers on nonhomogeneous coupled lines transmitting TEM modes have better characteristics at centimeter wavelengths than multicascade couplers. There are no sufficiently simple and accurate methods available for synthesizing such directional couplers: minimax optimization requires a rather close initial approximation and the small-reflections approximation yields satisfactory couplers with a large crosstalk attenuation but nonoptimal couplers with a small crosstalk attenuation. The feasibility of improving the approximation and thus the synthesis of directional couplers on nonhomogeneous coupled lines is demonstrated here in the case of an octupole consisting of two identical such lines. More accurate expressions for the integral of the local-reflection function are inserted into the scattering matrix and, with the aid of the Kotel'nikov series, the frequency characteristics are calculated for asymmetric directional couplers with a Chebyshev crosstalk attenuation characteristic, for asymmetric 180° couplers, and for symmetric directional couplers. A comparison of the results with those of actual syntheses indicates only a small error. Figures 3; references 15: 8 Russian; 7 Western.

USSR UDC 621.372.54

A METHOD OF SYNTHESIZING DIGITAL, NARROW BAND FILTERS WITH A TRUNCATED PULSE RESPONSE CHARACTERISTIC

Leningrad IZV. VUZ:PRIBOROSTROYENIYE in Russian Vol 20, No 6, 1977 pp 25-29 manuscript received 5 Oct 76

VITYAZEV, V. V., and STEPASHKIN, A. I., of the Ryazan' Radio Engineering Institute

[Abstract] A procedure for synthesizing narrow band, nonrecursive filters is presented, which circumvents to a significant extent the difficulties in previous filter designs caused by the large operational memory volume needed to store preceding information on the signal being processed and the large number of multiplication operations for each readout of the input signal. This method is based on the fact that the algorithm for the sequential convolution of the readouts of the input signal and the pulse response readouts corresponding to them are replaced by a parallel convolution algorithm with rarefaction of the output narrow band signal readouts, and their subsequent restoration by an interpolator. The advantage gained

in the number of arithmetic operations and the volume of the operational memory is compared with that of the usual direct convolution design, and mathematical expressions are given for the gain in these parameters. The paper is recommended by the Department of Automatics and Telemechanics. Figures 4; references: 2 Russian.

USSR UDC 621.371.542

A PROCEDURE FOR CALCULATING THE PARAMETERS OF A HIGH-SPEED, DIGITAL, HIGH PASS FILTER

Leningrad IZV. VUZ:PRIBOROSTROYENIYE in Russian Vol 20 No 6, 1977 pp 45-49 manuscript received 19 Nov 75

GOLITSYN, V. V., Ukrainian Correspondence Polytechnical Institute

[Abstract] The problem of shaping the frequency response characteristic of a nonrecursive, digital, high pass filter is treated. It is required that a minimum number of multiplications be used in the filter. The problem is reduced to interpolating the function (sin z)/z with a nonlinear trigonometric polynomial. A procedure is given for finding the roots of the system of trigonometric equations by means of sequentially increasing the order of the system. A sample calculation is performed for a filter formed by the combination of four rectangular pulse characteristics of equal length in accordance with the procedure presented. It is found that this high pass filter provides for a fast signal processing rate on a digital computer, where this rate does not depend on the width of the pulse response characteristic and that the proposed procedure permits the design of filters having a high degree of frequency response uniformity in the passband. This paper is recommended by the Department of Electric Drive and Automation of Industrial Installations. Figures 2; tables 1; references: 3 Russian.

USSR UDC 621.391.2

A NONLINEAR FILTER WITH A PRIORI DEFINED PARAMETERS

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 22, No 7, Jul 77 pp 1406-1413 manuscript received 31 Mar 76

VASIL'YEV, V. V.

[Abstract] A method is suggested for synthesis of a filter for the nonlinear problem of filtration, intended to allow the possibility of independent determination of the statistical characteristics of error and to use them

to determine the parameters of the filter. It is shown that the filter evaluates a non-observed process with an accuracy no less than that of quasi-optimal nonlinear filters. Synthesis of the filter, based on minimization of the distance between the signal received and its analogue, produces a filter structure with deterministic parameters which can be calculated in advance. References: 8 Russian.

USSR UDC 621.391.2:681.32

RECURSIVE DIGITAL FILTERS WITH FINITE PEAK CHARACTERISTICS FOR SPECTRAL ANALYSIS IN THE BASIC SYSTEM OF VILENKIN-CRESTENSON FILTERS WITH A SLIPPING INTERVAL

Kiev IZV. VUZ:RADIOELEKTRONIKA in Russian Vol 20, No 4, Apr 77 pp 56-64 manuscript received 8 Sep 75; after revision, 5 Jul 76

ZELENKOV, A. V.

[Abstract] Recursive digital filters are synthesized for spectral analysis in a slipping interval with any base of the system of notation of variable Vilenkin-Crestenson functions (VCF). Various systems for construction of such DF are comparatively analyzed when the VCF are ordered as suggested by Paley, Kroneker and Walsh. Recursive and nonrecursive DF are compared and the conditions under which it is expedient to use recursive DF are defined. Effective measures are recommended for correction of the influence of quantization noise and finite word length: periodic zero reset of all DF locations resulting in small overall information losses only during the interval immediately following reset, and the use of correcting DF. Figures 5; references: 4 Russian.

USSR UDC 681.3.06

STABILITY OF RECURSIVE DIGITAL FILTERS

Moscow AVTOMATIKA I TELEMEKHANIKA in Russian No 7, Jul 77 pp 22-27 manuscript received 21 Apr 76

GOL'DENBERG, L. M., Leningrad

[Abstract] The two main sources of nonlinearity error in a recursive digital filter are truncation (rounding) of the results of arithmetical operations in the processors and overflow of the register. With the register capacity assumed to be adequate, the frequency criterion of stability for the dynamic

filter part is established with regard to both nonlinearities, independently in terms of equilibrium positions in the phase plane. The analysis is applied to a "basal" filter with all nonlinearities lumped into one component, whereupon some special cases are also considered. Figures 5; references: 5 Russian.

USSR UDC 681.816.062

A RESONANT FILTER WITH A GYRATOR

Leningrad IZV. VUZ:PRIBOROSTROYENIYE in Russian Vol 20, No 6, 1977 pp 96-101
manuscript received 16 Mar 76

VORONENKOV, V. YU., ZAKHAROV, V. K., and NAZIN G. P., Leningrad Polytechnical Institute imeni M. I. Kalinin

[Abstract] The design of moderately high Q resonant filters using gyrators based on series produced, integrated circuit operational amplifiers is discussed. Design equations and schematics of both the equivalent and working circuits are given for such a gyrator, which permits a substantial simplification of the filter circuitry while maintaining a rather high Q. The actual filter built in this case used 1UT401B op amps and had Q's between 20.6 and 30 for center frequencies from 585 to 2,150 Hz. A variant of the circuit yielded a Q of 48 at 1,210 Hz. The proposed gyrator circuit contains two standard op amps in all, does not require special tuning, and can be used in devices requiring an average Q. There is good agreement between the design values and the values found experimentally. The paper is recommended by the Department of Automatics and Computing Techniques. Figures 3; references: 4 Russian.

USSR UDC 621.372.061:621.372.832

WIDEBAND BRIDGE-TYPE POWER DIVIDERS BASED ON ELEMENTS HAVING LUMPED OR LUMPED-DISTRIBUTED PARAMETERS

Kiev IZV. VUZ:RADIOELEKTRONIKA in Russian Vol 20, No 5, May 77 pp 90-95
manuscript received 1 Dec 75; after revision, 4 Aug 76

KOTLYAR, M. YA., and BELLON, O. O.

[Abstract] A method is shown of designing power dividers with elements which have either lumped or lumped-distributed parameters. The device is regarded as a system of impedance transformers with either Chebyshev or Butterworth characteristics, one such transformer for matching each of the N loads to the voltage generator. The design procedure for a bridge-type power divider

based on this principle is outlined here for the case of lumped parameters, in which case Tables of Parameter Values are available. For the case of lumped-distributed parameters there are no Tables available, and the design requires the aid of a computer with an appropriate program. Figures 4; tables 1; references 8: 4 Russian, 4 Western.

USSR UDC 621.372.827

HIGHER-ORDER MODES IN MULTITHREAD TAPE HELICES

Kiev IZV. VUZ:RADIOELEKTRONIKA in Russian Vol 20, No 5, May 77 pp 3-10 manuscript received 26 Mar 76

GUDZENKO, YU. P., DUBROVKA, F. F., and NAYDENKO, V. I.

[Abstract] The advantage of using multithread helices in microwave devices are their wide frequency band and efficient interaction between the electron beam and the electromagnetic wave. The helical anisotropy of admittance is a valuable feature where distinct directional characteristics are required. The performance of open tape helices transmitting the fundamental and higher-order modes was analyzed by numerical calculations on a high-speed computer and experimentally on the basis of measurements. The transverse current was taken into account, but the model of a helically conducting cylinder was found inadequate. The approximation used here, on the other hand, yielded results closely agreeing with test data. According to this study, the number of helix threads most significantly affects the electrodynamic characteristics of modes, particularly the coupling impedance to higher space harmonics. As the number of threads is increased, the axial impedance with respect to the zeroth-order mode shifts toward a shorter wavelength, so that higher accelerating voltages can be applied and self-excitation of backward harmonics becomes easier to suppress. A multithread helix is preferable to a single-thread helix in operation with polarized fields and is preferable to resonator cavities in retarding systems. Figures 5; references 11: 9 Russian, 4 Western.

USSR UDC 621.372.852.6

DESIGN OF A WIDEBAND AUTOTRANSFORMER

Moscow RADIOTEKHNIKA in Russian Vol 32, No 7, Jul 77 pp 103-105 manuscript received 13 Sep 76

LONDON, S. YE., and TOMASHEVICH, S. V.

[Abstract] Amplifiers for HF and UHF systems use a simple autotransformer with a tapped winding in the form of a flat spiral around a magnet core. For

analyzing its performance over a wide frequency range ($f_{max}/f_{min} \geq 5$) one can use different equivalent circuit diagrams for the lower frequencies and the upper frequencies respectively. Only the latter present a problem and are considered here. With the edge effect and the capacitance to "ground" assumed negligible, the transmission matrix of an equivalent network of octupoles in cascade is calculated and, for the purpose of design optimization, the values of the characteristic impedances are determined which will make the maximum reflection coefficient minimum. The results are illustrated numerically and graphically. Figures 3; references: 1 Russian.

USSR UDC 621.372.632.029.65

A JOSEPHSON JUNCTION AS A MILLIMETER WAVE BAND MIXER-AMPLIFIER

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 22, No 7, Jul 77 pp 1527-1530 manuscript received 14 Apr 76

VYSTAVKIN, A. N., GUBANKOV, V. N., D'YAKOV, V. P., and SPITSYN, A. M.

[Abstract] A report is presented on the results of experimental quantitative estimates and investigations of the variation of beta (transformation factor) on the harmonic number of a heterodyne formed at a junction, heterodyne power p^h and the position of the working point on the volt-ampere characteristic of a junction. The experiments utilized superconducting point-niobium-niobium contacts with the following parameters: critical current I_0 40-500 μa, resistance in normal state R = 0.5-10 Ohm characteristic voltage $V_0 = I_0R$ = 100-500 μV. Results were analyzed for super conducting point contacts corresponding to the resistive model. Conversion of a signal with a frequency of 127 GHz to a signal at the IF of 8.6 GHz was studied, using klystron oscillators with frequencies of 136, 68, 45 and 6.8 GHz. The results produced confirmed the promise of using superconducting point contacts as mixer-amplifiers for high-sensitivity reception and measurement of frequencies in the millimeter and submillimeter wave bands. The authors thank K. K. Likharev for helpful discussions and N. D. Kozlov for making available niobium wire. Figures 3; tables 1; references 9: 3 Russian, 6 Western.

USSR UDC 621.375.7

SINGLE-FREQUENCY PARAMETRIC AMPLIFICATION IN THE 3 cm BAND WITH SELF-PUMPING ON A JOSEPHSON JUNCTION

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 22, No 7, Jul 77 pp 1530-1533 manuscript received 7 Sep 76

VYSTAVKIN, A. N., GUBANKOV, V. N., KUZ'MIN, L. S., LIKHAREV, K. K., and MIGULIN, V. V.

[Abstract] A Josephson junction with low capacitance can be used as a parametric element pumped by its own oscillation at the Josephson frequency. This work reports on the creation of a laboratory model and preliminary investigation of the characteristics of a 3-cm band amplifier operating at liquid helium temperature (4.2 K) using point superconducting Josephson contact junctions. The amplifier consisted of a half wave coaxial resonator operating in reflection with a resonant frequency of 9370 MHz. The contacts were formed in liquid helium so that their asymptotic resistance R was low (0.05 to 0.3 OHm), because the fluctuation voltage increases with resistance. The amplitude-frequency characteristics of the amplifier were measured using a type G4-109 oscillator, the signal from which was fed to the resonator through an uncooled ferrite circulator. The experiments showed that a single-frequency parametric

amplifier can be made with noise properties near the theoretical limit. The effectiveness is also near the theoretical limit, although it is less than the maximum possible value by one and one-half orders of magnitude. Coupling of the resonator with the line must be increased in order to utilize this reserve. Figures 2; references 7: 6 Russian, 1 Western.

USSR UDC 533.951

SCATTERING AND TRANSFORMATION OF ELECTROMAGNETIC WAVES ON A HEAVY CHARGED PARTICLE IN A PLASMA

Gor'kiy IZV. VUZ:RADIOFIZIKA in Russian Vol 20, No 5, 1977 pp 678-695
manuscript received 10 Feb 75; after unification, 20 Nov 75

GORBUNOV, L. M., and MATEVOSYAN, G. G., Institute of Physics imeni P. N. Lebedev, Academy of Sciences, USSR

[Abstract] This work studies the scattering and transformation of electromagnetic waves on a non-moving or moving heavy particle. Primary attention is given to collective effects, which arise because the fact that it is not the particle itself which oscillates in the field of the incident wave, but rather the charges of the polarization cloud which surrounds it. In the first part of the work, based on general relationships from nonlinear electrodynamics, a cross section is produced which is made specific for a fully ionized plasma. In part 2, scattering and transformation on a particle at rest are studied. It is shown that for waves with a length much greater than the Debye radius, scattering has the same radiation pattern as for scattering on a point particle. If the length of the incident wave is comparable to or less than the Debye radius, the scattered radiation is primarily directed forward. The transformation factor on a heavy particle at rest is defined. In part 3, scattering and transformation on a particle moving at a velocity exceeding the thermal velocity of ions but less than the thermal velocity of electrons are studied. The particle radiates longitudinal ionic-sonic waves. The authors thank L. M. Anosov for making numerical calculations. Figures 5; references: 17 Russian.

USSR UDC 621.371

RESONANT INTERACTION OF POWERFUL MODULATED RADIO WAVES

Gorkiy IZV. VUZ:RADIOFIZIKA in Russian Vol 20, No 5, 1977 pp 788-790
manuscript received 2 Mar 76

PLOTKIN, V. V., and FREYMAN, M. YE., Institute of Geology and Geophysics, Siberian affiliate, Academy of Sciences, USSR

[Abstract] A study is made of nonlinear distortions of modulated radio waves resulting from resonant interactions when two powerful modulated radio waves propagate through a homogeneous and isotropic plasma with collisions. It is found that the nonlinear distortion of the waves is determined to a great extent by the Doppler shift of the carrier frequency upon reflection. Formulas are presented for the distortions of modulation, produced according to the theory of perturbations. It is noted that the nonlinear distortions of modulation in question, resulting from resonant interaction of radio waves,

are also manifested when the waves strike the ionosphere at an angle. These distortions cannot be ignored in the practice of radio broadcasting. The authors thank I. M. Vilenskiy for attention to the work. References: 4 Russian.

USSR UDC 621.371.25

ADIABATIC MODES OF SHORT RADIO WAVES IN A HORIZONTALLY HETEROGENEOUS IONOSPHERE

Gor'kiy IZV. VUZ:RADIOFIZIKA in Russian No 5, 1977 pp 659-668 manuscript received 2 Feb 76; after completion, 4 Oct 76

BORISOV, N. D., and GUREVICH, A. V., Institute of Terrestrial Magnetism, The Ionosphere and Propagation of Radio Waves, Academy of Sciences, USSR

[Abstract] The purpose of this work is to develop specific methods for determination of the adiabatic modes for a horizontally heterogeneous ionosphere. In sections 2 and 3, adiabatic modes are found for certain models of the relationships of dielectric permeability to horizontal coordinates. Section 4 develops a general method for arbitrary, smoothly changing ionospheric waveguides. This method, however, is not applicable to lower lying modes, but in combination with the approach developed in section 2, it allows a complete solution of the problem of construction of adiabatic modes. In section 5, adiabatic modes are used to analyze a specific example of the propagation of a batch of waves over a single-skip track. Figures 1; references 6: 5 Russian, 1 Western.

USSR UDC 621.371.25

THE EXCITATION OF SOUND IN THE IONOSPHERE BY POWERFUL RADIO WAVES

Gor'kiy IZV. VUZ:RADIOFIZIKA in Russian Vol 20, No 5, 1977 pp 787-788 manuscript received 6 Jul 76

KARASHTIN, A. N., MITYAKOV, N. A., RAPOPORT, V. O., and TRAKHTENGERTS, V. YU., Scientific-Research Institute for Radio Physics

[Abstract] This work studies the excitation of infralow-frequency sonic waves in the lower ionosphere by powerful radio waves, which cause heating of the neutral component of the ionosphere. The periodic heating of molecules leads to the development of periodic variations in pressure of the neutral gas. The ionospheric area thus excited can be considered a source of sonic waves at the frequency with which the molecules are heated. The radiation may become

significant if the space-time structure of the heated area is favorable. The processes in question have time characteristics such that the influence of such natural phenomena as winds is much less significant than on effects related to slow heating of neutral particles by powerful radio waves, which has been discussed earlier. Figures 1; references: 5 Russian.

USSR UDC 621.371.334

DIFFRACTION ON A SLIT AND STRIP: ACCURACY OF VARIOUS ASYMPTOTIC METHODS

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 22, No 7, Jul 77 pp 1341-1349 manuscript received 3 Jun 75; after revision, 18 Feb 77

POPICHENKO, V. A.

[Abstract] A study was made of the diffraction of a plane wave on a strip for two polarizations of the incident plane wave. The accuracy of calculation of the scattering diagram was numerically estimated, using a non-smooth asymptotic formula produced by the self-matched field method with separation of primary diffraction, and a smooth asymptotic formula produced by the self-matched field method with both primary and secondary diffraction separated. It is shown that the nonsmooth formula, considering two and three standard waves for normal incidence and the smooth formula considering a single standard wave for arbitrary angle of incidence can significantly increase the accuracy of calculation of the scattering pattern. The results produced allow evaluation of the effectiveness of various asymptotic methods, and show that the smooth asymptotic formulas provide the best accuracy. A comparison showed that the accuracy of calculation of the scattering pattern where $ka \leq \sqrt{80}$ is higher if smooth asymptotic formulas are used for the interaction coefficient. The author thanks L. A. Vaynshteyn and B. Ye. Kinber for editing the paper and discussion of its results, as well as R. Kh. Kheston for valuable advice. The author is also grateful to A. N. Gorgoshidz for making available the results of calculations in precise order, long in advance of their publication. Figures 3; tables 3; references 15: 12 Russian, 3 Western.

USSR UDC 621.317.001.2:681.3

AUTOMATION OF CIRCUIT ENGINEERING DESIGN OF ELECTRONIC UNITS FOR MEASURING FACILITIES

Moscow PRIBORY I SISTEMY UPRAVLENIYA in Russian No 2, 1977 pp 19-20

BELYAYEVSKIY, A. I., and MARGOLIN, A. M., Candidates in Technical Sciences; BEDNARCHUK, V. N., IVANOV, S. L., PROSKURNIKOV, M. I., SOLOV'YEV, A. G., TIKHONOV, N. D., and SHPARBERG, L. A., Engineers

[Abstract] Several preliminary tasks face the engineer in the automated planning of electronic circuits, such as: 1) automation of the process of constructing mathematical models of circuits suitable for calculations on both direct and alternating current; 2) development and program realization of algorithms to be used in determining the metrological characteristics (MC) of electronic units of measuring facilities (EUMF) at the planning stage; and 3) development of algorithms and programs for the parametric synthesis of EUMF for given MC. Brief descriptions of these three tasks are given, along with information on mathematical and programming guarantees as worked out by the authors. References: 8 Russian.

USSR UDC 621.317.001.2:681.3

DESIGN AUTOMATION OF INFORMATION-MEASURING SYSTEMS ON THE BASIS OF ANALYTICAL DESCRIPTION

Moscow PRIBORY I SISTEMY UPRAVLENIYA in Russian No 2, 1977 pp 20-22

IVANOV, V. N., Candidate in Technical Sciences

[Abstract] Considerable experience has already been acquired in automation of the individual stages of planning information-measuring systems (IMS). However, problems in the automation of a number of the early planning stages have not so far received adequate practical solutions. These include the choice of a planning structure for IMS, analysis of possible variants of IMS structures on the bases of selected criteria, and the choice of optimal characteristics of units for the planned system, among others. The cause of difficulties in this area is primarily the complexity of formalization of methods to be used in the analysis and synthesis of IMS.

The author outlines one possible approach to the solution of these problems in the area of metrological characteristics (MC); he proposes, as a basic index of the quality of IMS functioning, an analytical description (modeling) of individual units and of the system as a whole, with the use of operators defining their functioning under operational conditions. The basic points in the construction of a complex of applied analysis programs for IMS and the

specific tasks of synthesis are listed. The algorithms proposed have already found application in a number of practical problems in the synthesis of concrete IMS, and are used in automation of planning in the field of electro-measuring technology. References: 4 Russian.

USSR UDC 621.317.729.085.36.088

ANALYSIS OF METHODS FOR INCREASING THE NOISE IMMUNITY OF ANALOG-DIGITAL INTEGRATING CONVERTERS IN DATA TRANSMISSION SYSTEMS

Moscow PRIBORY I SISTEMY UPRAVLENIYA in Russian No 2, 1977 pp 26-28

SOKOLOV, V. I., TOUBIN, V. G., and GOLUB, YU. G., engineers; and SELIBER, A. B., and RAMANOVSKIY, V. R., candidates in technical sciences

[Abstract] Noise is one of the prominent factors which increase the error of information-measuring systems (IMS). The effect of noise has become particularly strong, as a result of the high degree of physical dispersion of primary IMS converters, the significant length of communication lines, the great degree of high-speed action, and, consequently, the very wide passbands now in use. The authors analyze methods for improving the noise immunity of the digital integrating voltmeters (DIV) now widely used in IMS. They propose, in particular, a method of assigning integration time for measured voltage within the DIV--a method which will assure increase in noise immunity and high-speed action in voltage measurement. The authors regard improvements in the primary converters and increase of noise immunity of the basic IMS unit (the analog-digital converter, or digital voltmeter) as an essential means of noise control. Figures 2; references 9: 8 Russian; 1 Western.

USSR UDC 621.317.825.2

TEMPERATURE-VARISTOR CHARACTERISTICS OF POSISTORS

Moscow PRIBORY I SISTEMY UPRAVLENIYA in Russian No 2, 1977 pp 28-29

VOROKHOVSKIY, YA. L., VOLKOV, A. A., GOROKHOV, V. I., DIANOVA, N. A., and PETROSYAN, I. G., engineers

[Abstract] Several types of Soviet-produced posistors [thermally-sensitive resistors] have been developed and a number of their qualities have been studied. The possibility of the use of posistors as self-regulating heating elements has been studied. Operation of the posistor as a self-regulating heating element is determined by the fact that it precisely combines the properties of both the thermoresistor and the varistor. Despite the

promising quality of the posistor as a heating element, a serious impediment to the development of posistor-based thermostatized elements is the quite significant spread of their characteristics at temperatures above the Curie temperature. The ST6-1B posistor, for example, shows a resistance varying from 650 to 5,000 Ω, at 72°C and 13 V. The authors undertake a mathematical analysis aimed at securing stabilized characteristics of the posistor. Figures 2; references 5: 4 Russian; 1 Western.

USSR UDC 621.385.632.14.032.26

ONE METHOD OF EXPERIMENTAL MEASUREMENT OF THE NOISE PARAMETERS OF O-TYPE ELECTRONIC-OPTICAL SYSTEMS

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 22, No 7, Jul 77 pp 1445-1452 manuscript received 16 Feb 76

SHTYROV, A. I., ROZANOV, A. V., ZABOLOTSKIY, V. N., and KONOVALOV, V. I.

[Abstract] A method is presented for experimental measurement of the noise parameters Φ, Ψ, Λ, S and Π of electronic-optical systems, defining the minimum noise coefficient and conditions under which it is realized. The experiments are performed directly on a TWT model, eliminating the need to use special measurement klystrons. Full information on the noise properties of the EOS is produced directly by this method with subsequent processing of the results of measurements by an electronic digital computer using standard programs, the initial data being the characteristic parameters of the interaction space: the gain parameter, the space charge parameter, the distributed loss parameter and the desynchronism parameter, which are considered known. Relative error of 14 to 16 percent are achieved. Figures 2; references 8: 6 Russian, 2 Western.

USSR UDC 621.316.726.078

THE ACCURACY OF PHASE SYNCHRONIZATION IN MULTICHANNEL PHASE-LOCKED LOOP SYSTEMS

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 22, No 7, Jul 77 pp 1414-1423 manuscript received 23 Mar 76

ZHILIN, N. S.

[Abstract] The accuracy of phase synchronization in multichannel phase-locked loop systems is analyzed using as an example a two-channel phase-setting device based on phase-lock looping using secondary beating. The device is intended to change the initial phase of a high-frequency signal by means of a low-frequency phase shifter installed in the circuit of the first master oscillator, and may contain several parallel channels, one of which is the reference channel. The accuracy of synchronization of the initial phase is determined for a single tuned oscillator, because the total error of the two-channel device is the result of the effects in each of the two channels. The degree of coupling between channels, nonlinear distortions in operating signals of the phase-locked loop system as well as phase relationships between harmonic components and the type of characteristics of the nonlinear elements, influence the accuracy of synchronization of the initial phase of the tuned oscillator. The presence of coupling between channels reduces the stability of the system and causes frequency shift in the stable mode, so that coupling between channels must be reduced by using nonlinear elements with characteristics as close as possible to quadratic, increasing the filtration of the reference signal and the output voltages of the mixers, although this is not conducive to stable operation of the channels. Figures 1; references: 4 Russian.

USSR UDC 621.373.029.64

INCREASE OF FREQUENCY STABILITY OF SOLID-STATE MICROWAVE OSCILLATORS

Moscow RADIOTEKHNIKA in Russian Vol 32, No 7, Jul 77 pp 79-84 manuscript received 4 Mar 76; after completion, 27 Oct 76

KOTIKOV, V. I., BARIKOV, V. A., and KUZNETSOV, O. V.

[Abstract] Solid-state microwave oscillators for heterodyne systems and low-power generators must be characterized by a high-frequency stability and a low level of AM as well as FM noise. The dependence of these performance parameters on the geometrical dimensions of the tank circuit is systematically analyzed here for a Gunn-effect oscillator operating in a rectangular waveguide. The analysis is based on the parallel equivalent circuit, with a nonlinear frequency-dependent admittance representing the active device and a linear frequency-dependent admittance representing the external circuit. The theoretical relations derived on this basis indicate, and experimental data confirm, that for maximum frequency stability and minimum FM noise, the waveguide should operate at a frequency near cutoff. With the operating mode of the active device fixed, the AM noise waveguide geometry, i.e., on the slope of its susceptance-frequency characteristic. Figures 6; tables 1; references 12: 10 Russian; 1 German; 1 Western.

USSR UDC 621.396.622.23

FREQUENCY-SHIFT MODULATORS

Kiev IZV. VUZ:RADIOELEKTRONIKA in Russian Vol 20, No 5, May 77 pp 75-79 manuscript received 18 Nov 75; after revision, 14 Jun 76

SHOSTAK, N. O., PERVUKHINA, G. A., and MARCHENKOV, S. YA.

[Abstract] Frequency-shift modulators are widely used in HF transmitter-receiver systems. Their optimum performance requires a minimum conversion loss and a maximum attenuation of the carrier as well as the other sideband at the output. Two variants of such a device are analyzed here. The first constitutes a system of four parametric diodes spaced by quarter-wavelengths. The second, functionally equivalent to the first one, consists of two diodes spaced by $\lambda/8$ and connected to a directional coupler through impedance-matching transformers. Calculations based on the equivalent-circuit equations indicate, and experimental results confirm, that the two-diode modulator performs no worse than the four-diode modulator. At the same time, the construction of a two-diode modulator is more reliable and its tuning much easier. Figures 5; references 5: 3 Russian, 2 Western.

USSR

UDC 542.67

A TWO-STAGE HOLOGRAPHIC REJECTOR FILTER

Gor'kiy IZV. VUZ:RADIOFIZIKA in Russian Vol 20, No 5, 1977 pp 705-711 manuscript received 20 Jan 75; after completion, 20 Oct 76

KORBUKOV, G. YE., KRUPITSKIY, E. I., and KULIKOV, V. V., Leningrad Electrical Engineering Institute of Communication

[Abstract] The rejector holographic filter analyzed here consists of two filtration stages. The first is a rejector holographic filter, "tuned" to the suppressed image and serving to filter the light distribution defined by the self- and mutual-correlation functions. The second corrects the distortions introduced by the first stage to the image output. The use of a two-stage rejector holographic filter, taking into consideration the difference not only in the amplitude-frequency but also in the phase spectra of images, can expand the range of tasks performed by three-dimensional filtration. An experiment was performed to verify the theoretical results. This consisted of the intentional distortion of the photographic image of a microcircuit, and detection of the distortions introduced by the two-stage holographic filter. The filter is most effective with complex noise with weak mutual correlation between signal and noise. The authors thank V. I. Adamchikov for assistance in conducting the experiment. Figures 5; references 7: 4 Russian, 3 Western.

USSR

UDC 621.383.932:681.327.2.082.5

USE OF A PHOTOTRANSISTOR MATRIX IN OPTICAL STORAGE DEVICES

Minsk IZVESTIYA AKADEMII NAUK BSSR, SERIYA FIZIKO-MATEMATICHESKIKH NAUK in Russian No 2, 1977 pp 97-101 manuscript received 12 Nov 75

SHMATIN, S. G., Institute of Electronics, Acad. Sci. BSSR

[Abstract] The purpose of this work is to estimate the possibility of using phototransistor matrices (PTM) in permanent holographic storage devices. The advantages and disadvantages of phototransistors in comparison to photodiodes are discussed. This work studied PTM in which the first emitter selects the number line as the phototransistors are combined into a matrix, while the second emitters are connected to the load resistance across which the output signal is taken. The basic characteristics of the matrices are as follows: threshold sensitivity 10^{-11}–10^{-12}J; photosensitive area 80x80 μm; distance between centers of photosensitive areas 100 μm; number of photosensitive elements 20 x 20. Reading is organized by strips. The results of the studies indicate that PTM of this type meet the requirements placed on matrices for optical storage units as to sensitivity and speed. The number of preamplifier circuits can also be reduced in comparison to holographic storage devices with photodiodes. Figures 4; references 8: 4 Russian; 3 Western; 1 Japanese.

USSR UDC 519.24

THE OPTIMUM DETECTION OF SIGNALS WITH A RANDOM TIME OF APPEARANCE

Moscow TEKHNICHESKAYA KIBERNETIKA in Russian No 3, 1977 pp 149-155 manuscript received 11 Oct 74

SOSULIN, YU. G., and FISHMAN, M. M., Moscow

[Abstract] Stochastic differential equations are employed for the synthesis of signal detection and evaluation systems. The moment of appearance of the signals is a random quantity with an arbitrary distribution. The types of signals treated include a quasi-determinant signal with an arbitrary distribution of the time of appearance of discord, and a pulsed signal with a random delay time. General relationships are derived, and the stochastic equations are found which describe the algorithms for generating the likelihood ratios for signal detection and evaluation. In synthesizing such optimum devices, this approach makes it possible to avoid the designs of complex and expensive systems which arise with the classical formulation of the problem for multichannel systems with an unknown delay time. Figures 3; references: 7 Russian.

USSR UDC 519.24

A GENERALIZED FREQUENCY METHOD FOR DESCRIBING THE DYNAMICS OF IMAGE ANALYSIS IN OPTICAL DF SYSTEMS

Moscow TEKHNICHESKAYA KIBERNETIKA in Russian No 3, 1977 pp 141-148 manuscript received 3 Jan 75

LEVSHIN, V. L.

[Abstract] A system consisting of focusing optics and a moving image analyzer is treated. The subsequent information processing channel is one-dimensional and is comprised of an aggregate of the usual radio links. The treatment is limited to the relationships at the output of the image analyzer, which converts the radiance field of the image (in the focal plane of the system) to an electrical signal which is a function of time. The radiating object, which appears against a spatially inhomogeneous random background, produces a radiance field which also varies with time. The conversion of this field to the electrical signal is accomplished by the image analyzer which moves in accordance with a complex law (which can also be random), and has a defined distribution of transmittance and sensitivity over the field of view. The probability characteristics of the useful and noise signals at the output of the image analyzer are derived. Figures 3; references: 3 Russian.

USSR UDC 621.391.8

ANALYSIS OF ESTIMATORS FOR THE MEAN EFFECTIVE SCATTERING CROSS SECTION IN REAL TIME

Kiev IZV. VUZ:RADIOELEKTRONIKA in Russian Vol 20, No 5, May 77 pp 43-50
manuscript received 28 Nov 75; after revision, 22 Nov 76

GORKIN, YU. A., and RADZIEVSKIY, V. G.

[Abstract] A comparative analysis is made of estimators for the mean power of reflected radar signals, equivalent to estimators of the mean electron paramagnetic resonance in objects. The likelihood function of N independent readings is calculated on the basis of either a gamma or a logarithmic normal probability distribution. Accordingly, quasioptimal asymptotically biased estimators and in one case the optimal (with respect to maximum likelihood) estimator are obtained for measurements in real time which involve a quadratic, a linear, or a logarithmic transfer function. Figures 4; references 6: 3 Russian, 3 Western.

USSR UDC 621.391.8

SEQUENCES OF RANDOM MULTIDIMENSIONAL SIGNALS AND METHODS TO DISTINGUISH THEM

Kiev IZV. VUZ:RADIOELEKTRONIKA in Russian Vol 20, No 4, Apr 77 pp 92-96
manuscript received 7 Jul 76; after revision, 14 Oct 76

GURVITS, V. L.

[Abstract] The problem of radar differentiation of several extended targets is formulated as the problem of differentiating among M hypotheses. The criterion of the minimal probability of error in differentiation is applied. It is shown that a comparatively simple algorithm can be derived for calculation of the likelihood function in the particular case of large values of R (number of readings). A structural diagram of a device generating the asymptotically optimal algorithm is presented; it eliminates the need to calculate multidimensional integrals. Although calculation of estimates of maximum likelihood generally requires large volumes of memory, in practice these estimates can be replaced by other simpler, consistent estimates such as recurrent estimates. Figures 2; references: 3 Russian, 1 Western.

USSR UDC 621.396.67

FIELD RERADIATED BY A LARGE SURFACE WITH RECEIVER AND TRANSMITTER SPREAD APART

Kiev IZV. VUZ:RADIOELEKTRONIKA in Russian Vol 20, No 5, May 77 pp 101-103
manuscript received 17 Nov 75

SHELUKHIN, O. I.

[Abstract] Reflections from the ground surface play an important role in short-range radar, where the receiver and transmitter are usually spread apart in space but near the covered territory, and the noise or quasi-noise probing signals are processed according to the correlation principle. When the distance between both antennas is relatively negligible, then the echo signal from a point target and the reradiated signal from the entire ground surface are evaluated in rectangular coordinates. When the distance between both antennas is not negligible, then the reflection coefficient cannot be regarded as a constant quantity and the incident wave must be regarded as a spherical one. For simplicity, the latter is now resolved into the sum of two plane waves and, on this basis, the total reflected signal is evaluated in spherical coordinates. The method is illustrated in the case of a probing signal representing a narrowband normal stationary random process. The reradiated field or its statistical characteristics can thus be evaluated for any values of the reflection coefficient. Figures 1; references: 2 Russian.

USSR UDC 621.396.96

DISTRIBUTION OF ELEMENTARY PHASES IN A MODEL OF A FLUCTUATING TARGET

Kiev IZV. VUZ:RADIOELEKTRONIKA in Russian Vol 20, No 4, Apr 77 pp 106-108
manuscript received 9 Jan 76

ATAYANTS, B. A., and YEZERSKIY, V. V.

[Abstract] In solving radar problems, a convenient mathematical model is required, which describes spatially distributed fluctuating targets. The model most widely used at present is the sum of N elementary waves with identical narrowband spectra. The joint probability density of the envelope and phase used in this model is determined by the distribution of amplitudes and phases of elementary waves. It is usually assumed that the elementary phases are either smoothly or normally distributed. However, in certain real cases the distribution may be neither smooth nor normal, and in fact may be asymmetrical. The beta distribution can describe the distribution of phases in a way which does not contradict the physical nature of the phenomena. For cases when the distribution of elementary phases follows the beta distribution, the mean values, dispersion of quadrature components and normalized mutual correlation function of quadrature components are determined. Several particular cases are studied. References: 6 Russian.

USSR UDC 621.396.96

DETECTION OF A SIGNAL WITH SPACE-TIME DISTORTIONS WITH A DETERMINISTIC COMPONENT BY A MULTICHANNEL RECEIVER SYSTEM

Kiev IZV. VUZ:RADIOELEKTRONIKA in Russian Vol 20, No 4, 4 Apr 77 pp 102-106
manuscript received 23 Dec 75; after revision, 12 Jul 76

RYBAKOV, B. S., and SEITOV, V. N.

[Abstract] In this work, the problem of multichannel detection of a stochastic signal X_i (t) with space-time distortions in the presence of white noise n_i (t) is extended to the case when the signal received contains an additive, deterministic (not space-time random) component X_{0i} (t). The parameters of X_{0i} (t) at the reception point are assumed known, while the properties of X_i (t) and n_i (t) are assigned as in an earlier work. Figures 2; references: 2 Russian.

USSR UDC 621.396.96

INFLUENCE OF CHAOTIC PULSE NOISE ON THE CHARACTERISTICS OF THE TIME DISCRIMINATOR OF A RADAR PULSE RANGE FINDER

Kiev IZV. VUZ:RADIOELEKTRONIKA in Russian Vol 20, No 4, Apr 77 pp 119-122
manuscript received 28 Apr 76; after revision, 2 Aug 76

RYNDYK, A. G., and OSOKIN, N. I.

[Abstract] A mixture of signal, noise and chaotic pulse noise acts on the input of a system consisting of a linear amplitude detector and a time discriminator. Under certain assumptions, seven situations are distinguished, differing in the relative position of pulses of noise, signal and tracking pulses. The probability is calculated for each situation, as well as the initial moments of first and second orders of the output voltage of the time discriminator; the discrimination and fluctuation characteristics of the time discriminator are found. Figures 3; references: 1 Russian.

USSR UDC 621.396.96.08

DISCRETE FILTRATION IN ELECTRONIC MEASURING DEVICE WITH RANDOM SIGNAL DROPOUTS

Kiev IZV. VUZ:RADIOELEKTRONIKA in Russian Vol 20, No 4, Apr 77 pp 65-72
manuscript received 26 Feb 76

GRISHIN, YU. P.

[Abstract] A study is made of a typical electronic digital meter, such as a rangefinder based on a specialized computer. The results of individual range measurements, converted to digital form, are fed to a filtration circuit or computer, the working algorithm of which is determined by the nature of change of the parameter being evaluated. The purpose of this work is to find optimal and quasi-optimal algorithms for filtration with random signal dropouts, when Kalman filtration is no longer optimal. An optimal estimate of filtration with random signal dropouts is found, the mechanism of which is described by a simple Markov chain. However, this method requires infinitely expandable storage capacity. Therefore, several particular cases are studied and the accuracy of the algorithms generated is compared. It is concluded that linear estimates are approximately two orders of magnitude less accurate than nonlinear estimates; that the optimal and adaptive algorithms have dispersions of error estimates differing by not more than 10-12 percent, although the optimal algorithm requires a priori knowledge of the value of Q (probability of presence of a signal). The algorithms studied in this work can minimize the filtration errors in an electronic measuring device both in the stable mode and during startup operations. Figures 4; references 5: 3 Russian; 2 Western.

USSR UDC 621.3.032.26.001.5

STUDY OF THE REGULARITIES OF INTERACTION OF 5-30 KeV ELECTRONS WITH MASSIVE SOLID BODIES

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 22, No 7, Jul 77 pp 1439-1444 manuscript received 31 May 76

VYATSKIN, A. YA., KABANOV, A. N., SMIRNOV, B. N., and KHRAMOV, V. YU.

[Abstract] Results are presented from experimental studies of the characteristics of interaction of electrons with initial energies between 5 and 30 KeV with massive metallic and semiconductor (Al, Cu, Au, Ge, Si) specimens using a film mass system. The characteristics of transmission and absorption of electrons are studied. Experimental equations are produced, describing the transmission and absorption of electrons in the massive solids. The characteristics are similar to the characteristics produced earlier in the 0.6-4 KeV range. Penetration of electrons into the mass is significantly less than into free films, most clearly seen in the surface area and resulting from the influence of fluxes of reflected electrons. The distribution of absorbed electrons in this energy range for Al, Cu, Au, Ge and Si is obtained for the first time. Figures 5; references 9: 5 Russian, 4 Western.

USSR UDC 621.315.592

MECHANISM HOLDING A THRESHOLD SWITCH IN THE "ON" STATE

Kiev IZV. VUZ:RADIOELEKTRONIKA in Russian Vol 20, No 5, May 77 pp 80-85 manuscript received 16 Apr 76; after revision, 17 Jun 76

GURIN, N. T., and SEMAK, D. G.

[Abstract] Sandwich-type switches consisting of amorphous chalcogenide layers with metal and silicon electrodes were tested, for the purpose of determining the mechanism which holds them in the ON state. An analysis of their voltage-current characteristics indicates the role of unipolar injection of electrons, always in the case of $Si_{12}Ge_{10}As_{30}Te_{48}$ glass, and the role of phase transition induced by the electric field in the case of As_2Se_3 glass. Figures 4; references 26: 7 Russian, 19 Western and Japanese.

USSR UDC 621.319.4-416

PLANAR THIN-FILM MICROWAVE CAPACITORS

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 22, No 7, Jul 77 pp 1537-1538 manuscript received 30 Mar 76

GAYDUKOV, M. M., KOZYREV, A. B., LIPCHINSKIY, A. G., and TER-MARTIROSYAN, L. T.

[Abstract] This work presents the results of measurement of the capacitance C and dielectric loss angle tangent of nonlinear capacitors based on $SrTiO_3$ films produced by reactive cathode sputtering. Measurements were performed at 1-2 GHz in the 77-300 K temperature range. The films were precipitated on sapphire plates oriented perpendicular to the c axis. Structural analysis of the films (at room temperature) showed that they have polycrystalline structure with mean crystal diameter 0.2 μm. Frequency dispersion was extremely low. The dielectric loss angle tangent either remained constant or dropped with an increase in bias voltage, remaining between 0.007 and 0.015 for frequencies of 1-2 GHz at 77 K. Comparison of the parameters of capacitors produced by sintering and by sputtering indicates that the latter have lower nonlinearity and about the same loss angle tangent. The phase transition temperature of the new films is 30-40 C higher than that of sintered films. Figures 2; tables 1; references 7: 6 Russian, 1 Western.

USSR UDC 621.372.54.037;372:681.32

"TRUNCATED" ALGORITHMS FOR FAST FOURIER-WALSH TRANSFORMATIONS

Moscow RADIOTEKHNIKA in Russian Vol 32, No 7, Jul 77 pp 15-20 manuscript received 21 Mar 76

YAROSLAVSKIY, L. P.

[Abstract] A universal bilaterally truncated algorithm is shown and its applicability to fast Fourier-Walsh transformations is demonstrated. A discrete Fourier-Walsh transformation is represented here in matrices and the truncated algorithm is derived on the assumption that nonzero elements of the original signal as well as transform coefficients are distributed over the initial range of corresponding sequences, their number being an integral power of 2. The results are presented graphically for a few typical specific cases. The efficiency of such an algorithm is evaluated in terms of the number of operations it requires for performing a Fourier transformation and by comparing this number with that which the untruncated algorithm requires. Figures 2; references 3: 2 Russian; 1 Western.

USSR UDC 621.313.048.5.001.5

A METHOD OF ENUMERATION OF THE RESULTS OF ACCELERATED TESTS FOR ELECTRIC AGING OF MACHINE INSULATION

Minsk IZV. VUZ:ENERGETIKA in Russian No 6, Jun 77 pp 47-53 manuscript received 6 Jun 76

MYAKININ, YE. G., Candidate in technical sciences, Dotsent, SAPLIN, L. A., engineer, and MOKEYEV, V. K., Candidate in technical sciences, Chelyabinsk Institute of Agricultural Mechanization and Electriciation

[Abstract] On the basis of the relation $E^m t = A$ between the electric field strength E and the service time t (with A and m denoting empirical constants), accelerated life tests of electrical insulation are performed at three levels of the electric field strength higher than nominal. The results are then extrapolated for a correct evaluation of service characteristics. The evaluation shown here is based on the exponential probability distribution of insulation life depending on the electric field strength and on the insulation surface area. The method takes into consideration the effect of two aging mechanisms, a slow one dominant below breakdown and a fast one dominant above breakdown, so that two distinct ranges appear on the life curve. Test results for mica tape with a compound and for mica tape graded with glass cloth have been evaluated by this method and, on this basis, a better performance of graded insulation on copper wire with small corner radii is predicted. The paper is presented by the Department of High Voltage Current. Figures 3; tables 1; references: 8 Russian.

USSR UDC 621.314.2

OPERATION OF A CONVERTER IN THE RING MODE WITH MAGNETIZATION OF POWER TRANSFORMER

Novocherkassk IZV. VUZ:ELEKTROMEKHANIKA in Russian No 6, 1977 pp 645-652 manuscript received 22 Jan 75

KOCHKIN, VALERIY IVANOVICH, section director of the Moscow division of the Scientific Research Institute of Direct Current, and YAKIMETS, IGOR' VLADIMIROVICH, candidate in technical sciences and senior scientific associate of the Power Engineering Institute imeni G. M. Krzhizhanovskiy

[Abstract] This paper is devoted to an analysis of the operation of a converter in a ring circuit simulating overloading conditions of rectifiers in an accident situation. It is demonstrated that under these conditions direct-current components of the circuit coil's phase currents are present and that these components are capable of saturing the magnetic circuit of the power transformer. A distinctive feature of a ring circuit used to test rectifiers under conditions close to actual, for which a reactor

serves as the load, is that one half of the converter bridge circuit operates in the rectifier mode, and the other in the inverter. It is possible to create overloading conditions in a ring circuit. The d.c. components of the phase currents of a power transformer's circuit coil magnetize the transformer's magnetic circuit and cause an abrupt increase in magnetizing current. Because of the fact that this situation can continue for several tenths of a second, it is necessary to know the magnitude of and nature of the change in currents in phases of the transformer's primary and secondary windings. This will make it possible to estimate the load capacity of rectifiers, make a good choice of protective devices, and judge whether these conditions are allowable with regard to normal operation of the transformer. A method is suggested here for calculating currents in a converter in the steady-state mode which takes into account the change in the transformer's resistance to mutual inductance resulting from saturation. The characteristics of transformer steel are taken into account, particularly with regard to the superposition of direct and harmonic magnetic fields. Curves are derived expressing the relationship between magnetic induction and the strength of the field in the steel with direct superposed magnetization. Experimental and calculated curves are shown which express the change in a transformer's resistance to mutual inductance under direct superposed magnetization. Calculation formulas given here are judged sufficiently accurate for practical application. The results obtained here will be useful in considering questions relating to estimating the load capacity of rectifiers and evaluating the performance of converters in high-power d.c. transmission lines. Figures 4; tables 1; references: 5 Russian.

USSR UDC [621.314:621.3.013]001.24

CALCULATION OF THE MAGNETIC LEAKAGE FIELD OF A TRANSFORMER USING A CYLINDRICAL SYSTEM OF COORDINATES

Novocherkassk IZV. VUZ:ELEKTROMEKHANIKA in Russian No 6, 1977 pp 637-644
manuscript received 18 Apr 75; after completion, 23 Jul 75

LUKUTIN, VLADIMIR ALEKSEYEVICH, candidate in technical sciences, Dotsent, Tomsk Polytechnical Institute, and TATEVOSYAN, ALEKSANDR SERGEYEVICH, assistant, Tomsk Polytechnical Institute

[Abstract] The three-dimensional nature of the field studied, complicated boundary conditions, and the presence of ferromagnetic materials cause considerable difficulty in finding analytical expressions for the magnetic leakage flux density vector in the area around a transformer's coils. The leakage field is often considered to be two-dimensional and the influence of adjacent cores and the wall of the container on the field is disregarded and the magnetic permeability of the cores and cross pieces of the yoke is considered infinitely great. This paper offers an approximate analytical calculation of the leakage field, which takes into account the finiteness

of the magnetic permeability of steel structural elements. The direct variation solution to the problem without sacrificing precision. Consideration is given to the leakage field of a single-phase transformer in the core-and-container zone. If the bar of the core is one axis, then in any section orthogonal to this axis the boundaries of the coils, container, and bar will represent concentric circles. It is thus possible to assume that the leakage field will possess axial symmetry. A Poisson equation is given to describe a field of this type in the core-and-container area in a cylindrical system of coordinates. Calculation formulas are obtained which describe directly the leakage field of a single-phase transformer operating in the open-circuit mode. These formulas contain all the major geometrical dimensions of the core-and-container region and coils and the distance to the walls of the container and cross pieces of the yoke. A study can be made of the leakage field for the short-circuit mode by using the method of superposing fields from each of the coils while taking into account the direction and magnitude of currents in them. Calculation results were checked by taking full-scale measurements of the radial and axial components of the magnetic induction vector of the leakage field in the space between the magnetic circuit's core and the wall of the container. Good agreement was obtained. Calculations were made on a "Nairi" computer. A diagram is shown of the magnetic leakage field in the core-and-container zone, which was calculated by the method described here. Figures 2; references: 9 Russian.

USSR

RELAYS USING HERMETICALLY SEALED, MAGNETICALLY ACTUATED, HIGH POWER REED SWITCHES

Moscow PROMYSHLENNAYA ENERGETIKA in Russian No 7, Jul 77 pp 61-62

[Abstract] A new series of magnetically actuated reed switches with a high power handling capability are described. The switch relays are packaged in standard modules approximately 90 x 70 x 39 mm overall. The driving coil power does not exceed 2 watts, and reliable contact closing is assured within 0.85 to 1.05 of the nominal values of 12, 24, 48 and 60 volts. This KMG series of relays is capable of switching loads with power factors between 0.4 and 1.0 at 380 volts and 50 Hz, at power levels up to 11,400 volt-amperes. Depending on the load, the duty cycle runs from 600 to 1,200 actuations per hour, and the overall number of actuations is rated as high as 10^8 for the lightest loads. Schematics and drawings of the relays are shown, and data on them are presented in tabular form. Figures 1; tables 2.

USSR UDC 621.385.6

DETERMINATION OF THE MANUFACTURING TOLERANCES ON FUNCTIONAL COMPONENTS FOR MICROWAVE ELECTRON DEVICES WITH PERMANENT INTERACTION

Kiev IZV. VUZ:RADIOELEKTRONIKA in Russian Vol 20, No 5, May 77 pp 11-22
manuscript received 20 Feb 76

GLEYZER, V. V., GOLUBENTSEV, A. F., KATS, A. M., and MINKIN, L. M.

[Abstract] The general problem of tolerances in microwave electron devices is formulated and a procedure is proposed for determining the tolerances where such devices contain functional components which constitute systems with longitudinally distributed parameters. Manufacturing variances are found to be one major source of discrepancy between nominal and actual parameters of electric circuits and, in this case, treated as random functions of the space coordinates. The problem is thus reduced to differential or integro-differential equations with stochastic coefficients. A method of solution is proposed which assumes a normal distribution of random values of the output parameter and leads to a simple analytical relation between tolerances on this parameter and tolerances on the input perturbations, i.e., the variance of geometrical dimensions, material properties, and, accordingly, electrodynamic characteristics of the components. This method is illustrated here on the reflection coefficient of transmission lines with a fluctuating characteristic impedance, on the electrodynamic characteristics of a retarding system for microwave tubes with permanent interaction, and on the gain and the noise factor of a linear traveling-wave tube. References 15: 13 Russian, 2 Western.

USSR UDC [538.2.001.24:621.318.2]001

METHODS OF TAKING INTO ACCOUNT THE MAGNETIC PROPERTIES OF HYSTERESIS MATERIALS

Moscow IZVESTIYA AKADEMII NAUK SSSR, ENERGETIKA I TRANSPORT in Russian No 3, 1977 pp 90-98 manuscript received 19 Nov 74; after revision, 28 Oct 76

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[Abstract] Problems which take into account the magnetic properties of hysteresis materials in designing electromagnetic equipment have not been solved satisfactorily up to this time. There are practically no published data available regarding a numerical analysis of fields in hysteresis agents with a correct allowance for their magnetic properties. Most existing calculation methods assume that the induction, strength, and magnetization vectors (B, H, and J, respectively) are collinear, but this state is hardly ever encountered in practice. It is emphasized in this paper that in solving field problems for hysteresis materials it is necessary to determine not only the magnitude, but also the direction of all field vectors at each point of the material volume. This is possible only when a characteristic has been determined which takes into account the diversity of magnetic states of the hysteresis medium, i.e., vector hysteresis. Another important feature of a hysteresis medium is the dependence of its final state at the macro level on its "magnetic history." Another factor to be taken into account is the macroscopic anisotropy of the magnetic properties of the majority of hysteresis materials, especially of the highly coercive alloys used for permanent magnets. This anisotropy for one thing makes it necessary to introduce a new parameter--the angle between the strength vector and the direction of the magnetic texture. All these factors contribute to the difficulty of taking the entire combination of magnetic states of a hysteresis material into account in the presence of complicated patterns of magnetic reversal. The method suggested in this paper is based on taking into account the main physical factors determining magnetic reversal processes. Examples are given of a calculation of vector hysteresis characteristics for isotropic and anisotropic materials, and an illustration is given of the influence of various factors on the shape of the main hysteresis loop and specific hysteresis cycles. A mathematical model of hysteresis is presented, which is designed for solving field problems with a digital computer. This method reflects well all the qualitative features of hysteresis materials, such as the dependence of residual magnetization (or induction) and coercive force on the direction of the field with respect to the axis of anisotropy (direction of the texture), and the route taken by the original magnetization curve and specific hysteresis cycles. This model makes it possible to take into account the magnetic state of the material at any stage in its "magnetic history." Only a small number of parameters reflected in two equations has to be stored in the computer's memory. A comparison is made between calculated and experimental hysteresis characteristics for cast alloy YuDNK 24B; there is good agreement. Figures 4; references 10: 8 Russian, 2 Western.

USSR UDC 621.3:538.3

TWO-DIMENSIONAL PULSED ELECTROMAGNETIC FIELD OF MASSIVE CONDUCTORS

Moscow IZVESTIYA AKADEMII NAUK SSSR, ENERGETIKA I TRANSPORT in Russian No 3, 1977 pp 99-109 manuscript received 16 Jun 75; after revision, 9 Mar 76

MIKHAYLOV, V. M., Khar'kov

[Abstract] This paper offers two numerical formulations of the problem of calculating two-dimensional pulsed electromagnetic fields of massive conductors, which also make it possible to take into account the change in specific electrical resistance resulting from heating. The example used for study is a single-coil solenoid made of nonmagnetic material of rectangular cross section, through which a capacitor is discharged. A study is made of current distribution in this solenoid under these conditions. The electromagnetic field of this solenoid is plane-meridional. The first formulation is in the form of an integral equation. Recommendations are given for programming this formulation for a solution on a computer, by arriving at a system of algebraic equations which can be solved with standard programs. Correctness of this formulation and of the numerical solution to the problem are tested by considering one specific case; discharge of a capacitor through a thin solenoid with practically uniform distribution of current over its cross section, thus enabling the discharge current to be determined by formulas previously tested. Good agreement is obtained. The second formulation is in the form of a system of ordinary differential equations. This system is converted into a form suitable for numerical programming for a computer, and convenient for solution by the Runge-Kutta method. An example is given of solving linear problems by classical methods. Solution to the problem of calculating the two-dimensional pulsed electromagnetic field requires use of a smaller volume of the computer's memory when the problem is formulated as a system of ordinary differential equations; on the other hand, in specific cases less machine time is required when the problem is formulated as an integral equation. The discussion disregards the influence of the conducting wire in the capacitor discharge circuit. Strictly speaking, taking this influence into account requires consideration of a three-dimensional problem. It is pointed out in an appendix, however, that in many cases it is possible to make an estimate within the scope of the two-dimensional problem. This matter is discussed in some detail. Figures 5; tables 2; references: 16 Russian.

USSR UDC 621.396.69.536.21

CALCULATION OF THE TEMPERATURE FIELDS OF THE RADIATORS OF SEMICONDUCTOR DEVICES WITH A FLAT BASE AND PERIPHERAL FINS

Minsk IZV. VUZ:ENERGETIKA in Russian No 6, Jun 77 pp 141-146 manuscript received 3 Nov 76

PROKOPOV, V. G., SHERENKOVSKIY, YU. V., candidates in technical sciences, LEGKIY, V. M., candidate in technical sciences, Dotsent, and TUPITSYN, YU. K., engineer, Order-of-Lenin Kiev Polytechnic Institute imeni Fiftieth Anniversary of the Great Socialist October Revolution

[Abstract] An engineering method of calculating the temperature field of radiators with a flat base and peripheral fins is shown, based on relations describing the steady-state temperature distribution with natural or forced convection. The base is made of a flat square plate, with a symmetric array of strips cut out and bent at right angles along each side. For the purpose of analysis, such a radiator is replaced with an equivalent finless one heated across a concentric inner circle of a certain radius and cooled along the outer zone between this circle and the square periphery. For the inner zone the differential equation of heat conduction is solved exactly with the appropriate boundary conditions. The outer zone is treated as a hollow square prism with a coaxial cylindrical inside surface, and the problem is solved approximately with the aid of the electric circuit analogy so as to avoid slowly converging series. This method has been verified by electrothermal simulation and by actual tests with P210 and P214 transistors mounted on a strip of grade AMTs aluminum alloy, with the geometrical parameters of the finned base varying over wide ranges. The discrepancy between theoretical and experimental results did not exceed 5 percent. The paper is presented by the Department of Steam Generator Construction and Engineering Thermophysics. Figures 3; references 3: 2 Russian, 1 Western.

USSR UDC 538.56

APPLICATION OF THE SIMPLIFIED OPERATOR EQUATION TO ELECTROMAGNETIC FIELDS

Minsk IZV. VUZ:ENERGETIKA in Russian No 6, Jun 77 pp 35-40 manuscript received 20 Aug 76

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[Abstract] A method is shown which simplifies the calculation of electric charges, potentials, and currents in various systems. It applies to differential, integral, and integro-differential equations, which are all generalized in terms of linear operators. The gist of this method is to seek the approximate solution not over the entire field domain but only within a certain subdomain of a lower dimensionality, i.e., by projecting the field domain on such a subdomain while the respective exact operator is transformed to a corresponding approximate operator. The method is illustrated in the derivation of simpler equations for the potential distribution along the symmetry axis of a field, and for the charge distribution on equipotential surfaces. Its practical usefulness depends on the availability of efficient error estimators. A typical example is calculation of the charge distribution over plane electrodes forming an electrostatic lens. The paper is presented by the Department of Theoretical and General Electrical Engineering. Figures 1; references 4: 3 Russian, 1 Western.

USSR UDC 621.3.014.7

ANALYSIS WITH AN ANALOG COMPUTER OF PROCESSES IN ELECTRICAL NETWORKS WITH COMPENSATION OF PHASE-TO-GROUND FAULT CURRENT

Minsk IZV. VUZ:ENERGETIKA in Russian No 6, Jun 77 pp 29-34 manuscript received 26 May 76

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[Abstract] Processes which occur in electrical networks with an isolated neutral in the case of phase-to-ground fault have been simulated on MN-7M analog computers. The network model described here includes 12 operational amplifiers. The problem is simplified by assuming the frequency to be industrial or nearly industrial and, on this basis, using a single-phase equivalent circuit diagram. Full compensation of the short-to-ground current with an extra voltage source and with a linear arc-quenching inductor is included. This model is correct when the short-circuit current becomes quenched during the zero crossover of its fundamental component, but is not quite accurate when quenching occurs during the zero crossover of any of its harmonics, and it is then corrected by proper adjustment of the boundary

conditions. The error is thus determined by the computer accuracy, which lie within 3-5 percent. This method of simulation and analysis makes it possible to evaluate, both qualitatively and quantitatively, the effect of network and compensator parameters. The parameters of the compensating voltage source are, indeed, found to affect both the transient and the steady-state processes, namely the damping and the inductor tuning. The recovery voltage does not exceed the nominal phase voltage by more than 20 percent over a wide range of inductor tuning and compensating voltage. The results obtained in this study demonstrate the feasibility of compensating not only the capacitive component but also the resistive component of phase-to-ground fault currents in 6-10 kV networks. The paper is presented by the Department of Power Supply of Industrial Plants and Municipalities. Figures 4; references 5: 4 Russian, 1 Polish.

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