

JPRS 70515

20 January 1978

20000414 099

USSR AND EASTERN EUROPE SCIENTIFIC ABSTRACTS
ELECTRONICS AND ELECTRICAL ENGINEERING
No. 36

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BIBLIOGRAPHIC DATA SHEET	1. Report No. JPRS 70515	2.	3. Recipient's Accession No.
4. Title and Subtitle USSR AND EASTERN EUROPE SCIENTIFIC ABSTRACTS - ELECTRONICS AND ELECTRICAL ENGINEERING, No. 36		5. Report Date 20 January 1978	
7. Author(s)		6.	
9. Performing Organization Name and Address Joint Publications Research Service 1000 North Glebe Road Arlington, Virginia 22201		8. Performing Organization Rept. No.	
		10. Project/Task/Work Unit No.	
		11. Contract/Grant No.	
12. Sponsoring Organization Name and Address		13. Type of Report & Period Covered	
		14.	
15. Supplementary Notes			
16. Abstracts The report contains abstracts and news items on electronic materials, components, and devices, on circuit theory, pulse techniques, electromagnetic wave propagation, radar, quantum electronic theory, development and devices, miniaturization techniques on electric power machinery, power transmission, and nuclear power developments.			
17. Key Words and Document Analysis. 17a. Descriptors USSR Eastern Europe Antennas Electromagnetic Spectra Network Synthesis Instruments Lasers 17b. Identifiers/Open-Ended Terms 17c. COSATI Field/Group 9F, 9C, 9A, 20N			
18. Availability Statement Unlimited Availability Sold by NTIS Springfield, Virginia 22151		19. Security Class (This Report) UNCLASSIFIED	21. No. of Pages 89
		20. Security Class (This Page) UNCLASSIFIED	22. Price PC 705

20 January 1978

USSR AND EASTERN EUROPE SCIENTIFIC ABSTRACTS

ELECTRONICS AND ELECTRICAL ENGINEERING

No. 36

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ELECTRONICS
Amplifiers

USSR

UDC 621.375

SYNTHESIS OF PARAMETRICALLY INVARIANT COMPLEX-SIGNAL SELECTIVE AMPLIFIERS
AND AMPLIFIER-SHAPERS

Moscow RADIOTEKHNIKA in Russian Vol 32, No 10, Oct 77 pp 59-64 manuscript
received 2 Jun 76; after completion, 26 Sep 76

KRUCHININ, D. V.

[Abstract] Expanding the dynamic range of complex-signal amplifiers requires an increase in their sensitivity, which is possible to achieve by selection of a weak signal submerged in noise. Although selective amplifiers and amplifier-shapers differ, a method is shown by which both can be designed to be invariant with respect to deficiency of a priori information about the signal parameters. The algorithms of this synthesis are constructed for the case of an energy-limited mixture of an expected signal and an unknown noise at the input, with the response at the output to be as close as possible to the stipulated form regardless of the actual values of the input signal parameters. Such an algorithm is thus parametrically invariant. The structure of an amplifier is synthesized accordingly, first with ideal circuit components and then with corrective filters compensating for deviations of real components from ideal characteristics. Figures 2; references 11: 8 Russian, 3 Western.

USSR

UDC 621.375.029.64

DESIGN OF LINEAR SINGLE-STAGE TRANSISTORIZED MICROWAVE AMPLIFIERS WITH
LOSSLESS MATCHING NETWORKS

Moscow RADIOTEKHNIKA in Russian Vol 32, No 10, Oct 77 pp 79-83 manuscript
received 25 May 76; after completion, 1 Oct 76

PETROV, G. V. and TOLSTOY, A. I.

[Abstract] A microwave amplifier must be designed not only for a certain gain but also for proper VSW ratios at the input and at the output respectively. Such an amplifier which consists of a transistor and two matching networks is designed here on the basis of three equations expressing the gain and the two VSW ratios, each as functions of the coefficients of voltage reflection at the matching networks. These networks are assumed here to be passive and lossless, i.e., purely reactive and the variables are appropriately transformed to elements of the scattering matrix. A general solution is obtained for the simple case of a single-stage amplifier, analytically with the aid of circle diagrams and with the transistor represented as a fourpole network. The regions of existence of this solution are established in this way, and the boundaries of these regions found to depend only on the invariant gain

and on the ratio of forward to backward transmission coefficient, not on whether the transistor is conditionally or unconditionally stable. Figures 2; references 4: 2 Russian, 2 Western.

USSR

UDC 621.375.087.9

PRINCIPLES OF FREQUENCY CORRECTION IN MODERN INTEGRATED-CIRCUIT OPERATIONAL AMPLIFIERS

Moscow RADIOTEKHNIKA in Russian Vol 32, No 9, Sep 77 pp 56-64 manuscript received 13 Aug 75; after completion, 16 Aug 76

ALEKSENKO, A. G. and KOLOBET, YE. A.

[Abstract] At high frequencies the gain of multistage integrated-circuit operational amplifiers can drop at a rate higher than 12 dB/octave and oscillations can occur as a result of stray negative feedback. Such frequency characteristics are corrected to the desirable rate of drooping by insertion of poles and zeros into the original transfer function so that the gain will become lower where the phase shift exceeds 180° and the phase shift will become smaller where the gain exceeds unity. This is achieved by means of corrective networks, of which three kinds are considered here: shunting networks, feedback loops, and a parallel channel. The transfer functions and the Bode diagrams are calculated for several variants of such corrective networks, with the effect of amplifier reactances taken into account, for the main purpose of circuit design optimization. Figures 4; tables 1; references: 5 Western.

USSR

UDC 621.375.087.9

A WIDEBAND LOGARITHMIC AMPLIFIER

Moscow RADIOTEKHNIKA in Russian Vol 32, No 10, Oct 77 pp 99-104 manuscript received 17 Jan 77, after completion

YANISHEVSKIY, A. A.

[Abstract] An amplifier with logarithmic amplitude characteristics and a frequency range of many megahertz is needed for many technical applications, especially for measurements. Such a "truly" logarithmic amplifier, with the instantaneous output voltage proportional to the logarithm of the instantaneous input voltage, consists of several differential cascades and two commonbase output stages. The amplifier parameters are calculated from the characteristics of a single differential cascade over a wide range of input voltages.

Small-signal as well as large-signal performance is considered, both imposing unique requirements on the design. In the case of large input signals, the dynamic range is also limited by the amplitude of the maximum allowable input voltage. An analysis of deviations from the ideal characteristic because of the finite number of cascades indicates that a fairly accurate wide-band logarithmic amplifier is feasible with a small number of cascades. A numerical evaluation has also shown that 15-20 dB attenuation or amplification stages must be inserted between individual cascades, unless the range of input signals does not exceed 30 dB. Figures 5; references 6: 3 Russian; 3 Western.

USSR

UDC 621.396.61:621.382.3

CIRCUITS FOR CORRECTION OF AMPLITUDE-FREQUENCY CHARACTERISTICS OF TRANSISTORIZED WIDE-BAND POWER AMPLIFIERS

Moscow IZV.VUZ:RADIOELEKTRONIKA in Russian Vol 20, No 8, Aug 77 pp 45-52
manuscript received 17 May 76

KOZYREV, V. B. and LAVRUSHENKOV, V. G.

[Abstract] A description is presented of the construction of AFC correction circuits for wide-band transistorized power amplifiers operating both in class A and in class B. Experimental results are presented which demonstrate the possibility of constructing nontunable power amplifiers for decameter wave-band transmitters. Equations are derived for design of the elements of the correction circuit for the amplifiers over a broad range of frequencies. The experimental results confirm the correctness of the assumptions made and the possibility of constructing wide-band power amplifiers by the method suggested. Figures 6; references: 6 Russian.

USSR

UDC 656.25:621.317.7

INTEGRATED MICROCIRCUITS IN THE PONAB PREAMPLIFIER

Moscow AVTOMATIKA, TELEMEXHANIKA I SVYAZ' in Russian No 2, 1977 pp 9-11

BRODNIKOV, I. U., senior engineer, Urals Division of TsNII MPS [Central Research Institute for the Railroad Ministry] and MIRONOV, E. G., senior scientific worker, Candidate in Technical Sciences

[Abstract] The possibility was investigated at the Urals Division of TsNII MPS of using a MG-6 integrated microcircuit as a PONAB preamplifier. [See Avtomatika, Telemekhanika i Svyaz', No 8, 1975.] However, in the

interim industry has produced new, improved microcircuits. This article describes the characteristics of several of these microcircuits such as the 2SS841 (MG-9), 2SS842 (MG-10) and K284UDI (MG-11), as well as several versions of preamplifiers based on these microcircuits. All of the microcircuits described are manufactured by hybrid-film technology and are produced in a metal-glass body with 15 leads. The input stages are based on FET's. The 2SS841 microcircuit is a dc amplifier with a differential input stage using a selected pair of FET's. Schematic diagrams of the amplifiers using the 2SS841, 2SS842 and K284UDI microcircuits are presented. The microcircuits are powered using the standard power supply of the PONAB-3 with an additional voltage stabilizer consisting of 2 low power silicon transistors type MP116. Figures 3; tables 2.

Antennas

USSR

UDC 621.396.67

RADIATION OF A DIPOLE SURROUNDED BY A SPIRALLY CONDUCTING SPHERICAL ENVELOPE

Moscow IZV:VUZ:RADIOELEKTRONIKA in Russian Vol 20, No 8, Aug 77 pp 36-39
manuscript received 14 Apr 75; after revision, 1 Dec 75

BELICHENKO, V. P. and GOSHIN, G. G.

[Text of Soviet Abstract] A study is made of the radiation of an electric dipole surrounded by a spirally conducting spherical shell. Field polarization and radiation impedance are studied. Figures 2; references 6: 3 Russian; 3 Western. (c) IZV.VUZ.SSSR-RADIOELEKTRONIKA 1977

USSR

UDC 621.396.67

STUDY OF THE COUPLING OF APERTURE ANTENNAS LOCATED NEAR THE DIVISION BOUNDARY BETWEEN TWO MEDIA

Gor'kiy IZV.VUZ:RADIOFIZIKA in Russian Vol 20, No 8, 1977 pp 1201-1208
manuscript received 1 Jul 76

BODROV, V. V. and ZAICHKIN, D. I., Moscow Power Engineering Institute

[Abstract] Two apertures of finite dimensions are studied, located near the division boundary between two media (i.e., the earth and the air). The distance between the apertures is equal in order of magnitude to the dimensions of the Fresnel zone. Formulas are produced for the coupling factor of the two apertures for this case. Numerical results are produced for the case of synphase, uniform distribution of current in the apertures. The variation in coupling factor with the distance between apertures and their height above the division boundary of the media is analyzed. Calculations were performed on a BESM-4 electronic computer for the particular case where $l = 0$. Figures 3; references 7: 3 Russian; 4 Western.

USSR

UDC 621.396.67.012.12

EFFECT OF RADIAL PERIODIC PHASE ERRORS IN AN ASYMMETRIC APERTURE ON ITS RADIATION PATTERN

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 22, No 9, Sep 77 pp 1838-1846 manuscript received 17 Mar 76

BAKHRAKH, L. D., KREMENETSKIY, S. D., LOS', V. F. and NIKANOROV, A. A.

[Abstract] An analysis is made of the effect which a radially distributed phase error in an asymmetric aperture in a paraboloid of revolution has on its radiation pattern. The problem is reduced to that of an equivalent linear antenna with a periodic phase error of varying amplitude. This yields expressions which can serve as design formulas for large sectoral reflectors. A typical numerical solution is compared with experimental data and the agreement found satisfactory. Figures 4; references 3: 2 Russian; 1 Western.

USSR

UDC 621.396.677.83

REDUCED NOISE IMMUNITY OF ANTENNAS IN RADIO RELAY COMMUNICATION LINES

Moscow RADIOTEKHNIKA in Russian Vol 32, No 9, Sep 77 pp 37-41 manuscript received 29 Mar 76

FROLOV, O. P. and YAMPOL'SKIY, V. G.

[Abstract] The noise immunity of antennas, defined as the ratio of gain in the principal direction to gain in the direction of incoming noise, is determined by the built in directivity and noise protection of an antenna. In the case of radio relay communication this ratio must be regarded as a statistical quantity and characterized by probabilistic distribution laws. Such a distribution is calculated here for the typical case of a useful signal and an interference signal coming from two different directions with probability distributions depending on the channel clearance as well as on the properties of the medium (e.g., the vertical gradient of its dielectric permittivity). The results are applied specifically to a tropospheric radio relay line, and general expressions for the decrease of noise immunity are derived. Figures 2; references 5: 4 Russian, ; Western.

USSR

UDC 621.396.677.494

DIRECTIVE GAIN OF A PHASED ANTENNA ARRAY

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 22, No 9, Sep 77 pp 1847-1858
manuscript received 6 May 76

SODIN, L. G.

[Abstract] A linear antenna array is considered with an equidistant spacing of identical elements. Asymptotic expansions are obtained for the radiation power and the directive gain. The results are applied to an array with an equiamplitudinal and with a non-equiamplitudinal distribution of currents. Formulas are given for a few basic types of radiators and a few basic types of current distributions. Figures 3; tables 2; references 8: 6 Russian; 2 Western.

USSR

UDC 621.396.677.833.1

SYNTHESIS OF A MULTIELEMENT EXCITER FOR A PARABOLIC SCANNING ANTENNA

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 22, No 9, Sep 77 pp 1859-1865 manuscript received 10 Jun 76

KINBER, B. YE., KOMLYAR, A. B. and TSEYTLIN, V. B.

[Abstract] The synthesis of a multielement exciter for a reflector antenna consists of determining the location of its elements and determining the complex amplitudes of their excitation which yields the desired shift of the principal lobe away from the antenna axis. The criteria for optimizing the radiation pattern are defined in terms of a functional with respect to the beam displacement. This functional is minimized by varying the number N of elements and the complex amplitudes of $N-1$ elements, with the imaginary part of the amplitude of the first element set to zero and its real part found from the condition of constant power. This procedure does not necessarily yield the smallest possible minimum, but a sufficiently small minimum within a smooth, i.e., physically realizable, domain where small deviations of parameter values do not significantly increase the functional. This procedure has been applied to exciters for a parabolic reflector antenna, in the form of a linear array of three or five identical and identically oriented elements with a nonequidistance spacing along the focal line of the parabola. Figures 5; references: 1 Russian.

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

USSR

UDC 519.248

RELIABILITY OF A SYSTEM CONSISTING OF INTERDEPENDENT ELEMENTS

Riga AVTOMATIKA I VYCHISLITEL'NAYA TEKHNICA in Russian No 5, Sep/Oct 77
pp 26-27 manuscript received 16 Dec 76

PANIN, N. YE.

[Abstract] Equations are presented for calculation of the reliability of systems with an assigned sequence of operation of interdependent elements. Each element performs the same function repeatedly, always in the same sequence among the other elements. The equations initially produced are extremely complex, but simplifying assumptions can be used to reduce the complexity to within practical limits. References 3: 1 Russian; 2 Polish.

POLAND

UDC 621.3.049.001.24

RC NETWORK FIELD ANALYZER

Warsaw POMIARY AUTOMATYKA KONTROLA in Polish Vol 23, No 3, Mar 77 pp 84-85

MACIEJEWSKI, ANDRZEJ, M. A., Engr., NITECKI, PIOTR, M. A., Engr., OKONSKI, JERZY, M. A., Engr., and WAWER, WOJCIECH, M. A., Engr.; Research and Development Center for Mining Chemical Raw Materials, Krakow

[Abstract] A RC network field analyzer for solving engineering problems by the method of analog modeling is described. To build it, the logical and linear integrated elements of the type preferred in Poland were used. The analyzer was designed and constructed by the Research and Development Center for Mining Raw Materials of Krakow for the Institute of Hydraulic Engineering of the Krakow Polytechnic. Figures 2.

USSR

UDC 621.3.07:681.327.2

THEORETICAL PERFORMANCE ANALYSIS OF MAGNETIC MEMORY ARRAYS

Leningrad IZV.VUZ:PRIBOROSTROYENIYE in Russian Vol 20, No 7, Jul 77 pp 49-54
manuscript received 19 Jul 76

ZUYEV, V. I. Paper recommended by Chair of Electronic Computers, Moscow
Engineering Physics Institute

[Abstract] A mathematical model of the magnetization reversal process in memories, from any initial state, is developed on the basis of an equation for the rate of change of magnetic induction. With the aid of the π -theorem, the readout signal of a memory device has been reduced from a function of ten to a function of five variables and parameters. The performance range of a ferrite memory is now established, with the properties of such a device most expediently described by a set of three dynamic characteristics: the maximum readout signal, the reciprocal of its arrival time, and the reciprocal of the switch time. The performance range is defined in terms of maximum and minimum thresholds of "1" and "0" readout amplifiers. It is also represented graphically on voltage-current and current-current diagrams. Theoretical data for a model OOP YeS 1060 magnetic memory are compared with experimental data, for design purposes. Figures 4; references 8: 6 Russian; 2 Western.

USSR

UDC 621.371.162

MACHINE METHOD OF DETERMINATION OF EFFECTIVE SCATTERING SURFACE OF BODIES OF COMPLEX SHAPE

Moscow IZV.VUZ:RADIOELEKTRONIKA in Russian Vol 20, No 8, Aug 77 pp 96-99
manuscript received 3 May 76

VECHKANOV, G. P. and VECHKANOVA, R. A.

[Abstract] A method called the "method of cross sections" is suggested which avoids the problems of existing methods of machine calculation of the effective scattering surface, including the impossibility by current methods of automating determination of the "painted" portion of the surface of a complex body with arbitrary angles of observation. The basic idea of the method is that the body is cut by planes parallel to the direction of observation, unshaded elements of the surface are automatically determined and the fields of secondary radiation of these elements are added with automatic consideration of phases. The surface of the complex body is divided by the planes into elementary areas, the areas of the projections of which on the plane of analysis are equal, and have the shape of equilateral triangles with a single side length. A flow chart of the program is presented. The results of a test on simple shapes (cylinders, connected

cylinders) show the correctness of the method as suggested; it can be used to calculate the effective scattering surface of bodies of arbitrary complexity, as long as the dimensions and radii of curvature are significantly greater than the wave length. Figures 3; references 5: Russian.

USSR

UDC 621.372.852.2:621.382

ELECTRONIC COMPUTER-AIDED DESIGN OF DISCRETE PHASE SHIFTERS BASED ON SEMICONDUCTORS

Moscow RADIOTEKHNIKA in Russian Vol 32, No 9, Sep 77 pp 83-86 manuscript received 9 Jun 75; after completion, 13 Sep 76

KOZLOV, V. I., DVORKIN, O. E. and STAVITSKAYA, G. S.

[Abstract] Microwave phase shifters can be designed much faster, if experimental evaluation is preceded by calculation of the appropriate equivalent circuit. With the aid of a computer, it becomes possible to optimize a phase shifter circuit of any complexity and only the capacity of the computer memory limits the number of parameters that can be varied. The gist of such an optimization is to minimize the difference between calculated and required discrete phase steps, under given constraints imposed on the maximum losses or on the voltage standing wave ratio. The basic program is shown together with numerical data for three types of phase shifters: a "loaded line" phase shifter, a phase shifter on a hybrid ring, and a phase shifter with switchable channels. Figures 2; tables 2; references: 3 Russian.

USSR

UDC 656.2-50:681.14.006

USE OF THE "VIDEOTON-340" DISPLAY WITH THE "NAIRI-K" ELECTRONIC COMPUTER

Moscow AVTOMATIKA TELEMEXHANIKA I SVYAZ' in Russian No 9, 1977 pp 20-23

KARYAKIN, B. A., senior engineer, Gor'kiy Railroad Computer Center, and SIMAGIN, N. V., engineer

[Abstract] The "Videoton-340" display is not available for use as a peripheral device with the "Nairi-K" computer for automation of the operation of engineering shops. Use of the display eliminates output of information on punch tape and reading of the punch tape by a teleprinter. A flow chart is presented of the algorithm by which the computer outputs a character to the display. The use of the display at the computer center of the Gor'kiy Railroad is described. Figures 4.

USSR

UDC 681.322.17

TOPOLOGIC TRACING OF PRINTED CIRCUITS WITH REGULAR STRUCTURE

Moscow UPRAVLYAYUSHICHIYE SISTEMY I MASHINY in Russian No 3, May/Jun 77
pp 124-129 manuscript received 11 Mar 76; after completion, 26 Oct 76

SOSNITSKIY, A. V.

[Abstract] A topologic approach is suggested to the planning of printed circuits with regular structure of the mounting space. The topologic model of the printed circuit used allows transitions between layers and merging of tracks only at contact positions in microcircuits and plugs; the laying of tracks between the contact positions of a single group is forbidden. The algorithm for topologic tracking of connections allows them to be drawn without intersection. The approach suggested is suitable for printed circuits with a system of orthogonal channels of any type. The limitations introduced as to the positions of transitions between contacts and points of joining of paths, as well as the laying of paths between contact positions, is not a significant limitation and can be eliminated by improving the model and the algorithm. The topology model suggested can also be used for tracking with intersections. The model is sufficiently fast and simple to be used in the dialogue mode with computers. The program has been run on a Minsk-32 computer in FORTRAN. The number of instructions in the program is about 7,000. Figure 1; references 4: 3 Russian; 1 Western.

USSR

UDC 681.325.65

A DIALOGUE SYSTEM FOR PLANNING OF TOPOLOGIES OF HYBRID INTEGRATED CIRCUITS

Moscow UPRAVLYAYUSHICHIYE SISTEMY I MASHINY in Russian No 3, May/Jun 77
pp 114-118 manuscript received 10 Jun 76; after completion 20 Jan 77

PETRENKO, A. I., DOBRONRAVOV, O. YE., TSURIN, O. F., TROFIMOV, V. P.,
BOBOVSKIY, V. V. and MAKHINENKO, L. I.

[Abstract] A study is made of the stage of planning of the topology of hybrid integrated circuits. This stage is generally informal and is performed by qualified design engineers in cooperation with circuit design engineers. The main operations performed in this stage are: transformation of the elements of the circuit engineering solution to the corresponding geometric forms with consideration of the limitations applied by the technology used; placement of the elements on the substrate and in the corresponding layers; placement of contact areas and leads; testing of the topology produced according to a number of parameters (distance between elements, mutual placement of elements and leads, etc.). The sequence of stages of planning of a hybrid integrated circuit is presented in flow

chart form and a method is suggested for partially automating the topology planning process. The primary operations involved in topology planning by computer are: transformation of the circuit design components to the corresponding geometric form; placement of the geometric forms of contact areas and leads on the substrate; formation of connecting lines; checking of distances, dimensions, inspection of topology by layers; and outputting of the results. A flow chart for the program which performs a section of this work is presented. Corrections are introduced in the dialogue mode by a designer. The effectiveness of the planning system is determined not only by the reduction in time required for development of integrated circuit topology, by a factor of three to five, but also by the fact that the solutions produced are more nearly optimal, smaller, and more reliable than circuits planned by "manual" methods. Figures 4; references: 3 Russian.

USSR

UDC 681.325.5

TABULAR ALGORITHMIC FUNCTIONAL CONVERTERS

Riga AVTOMATIKA I VYCHISLITEL'NAYA TEKHNIKA in Russian No 5, Sep/Oct 77
pp 78-81 manuscript received 22 Mar77; after revision 17 Sep 76

MUKHOPAD, YU. F. and GARDER, V. M.

[Abstract] A study is made of two methods of calculation of the functional dependences which significantly expand the sphere of application of tabular-algorithm methods as concerns the accuracy and economy of realizations in comparison with the most recent solutions in this area. Neither method goes beyond the framework of the method of piecewise-linear approximation with a degree of approximation equal to the error of reproduction of the function. The methods of functional transformation can be particularly effectively used in those areas of technology where large permanent memory units are impractical. The methods can also be used in the design of highly productive homogeneous processors. Figures 3; tables 2; references: 5 Russian.

USSR

UDC 681.326.3

EFFECT OF THE PROCESSOR RESPONSE SPEED ON THE PERFORMANCE OF A DIGITAL CONTROL SYSTEM

Leningrad IZV.VUZ:PRIBOROSTROYENIYE in Russian Vol 20, No 7, Jul 77
pp 57-62 manuscript received 10 Dec 76

ALIYEV, T. I. Paper recommended by Chair of Computer Engineering, Leningrad Institute of Precision Mechanics and Optics

[Abstract] A digital control system with a single high-speed processor is regarded here as a large-scale service system with one servicing device, namely a processor, and with unlimited queuing of incoming messages. The performance of such a system operating in real time is determined by the queuing time, which in turn is a nonlinear function of the processor response speed in various servicing modes. Accordingly, the performance of a digital control system is now evaluated as a function of the processor response speed. The result indicates that, with the total load remaining the same, a processor operating at a higher speed contributes to a more efficient servicing of messages. Figures 2; references 4: 2 Russian; 2 Western.

USSR

UDC 682.326.34

MULTICHANNEL PULSE DISTRIBUTOR

Novocherkassk IZV.VUZ:ELEKTROMEKHANIKA in Russian No 7, Jul 77 pp 835-836

YERMAKOV, VLADIMIR FILIPOVICH, assistant, Novocherkassk Polytechnical Institute

[Abstract] A description is presented of a 64-channel pulse distributor with a flip-flop counter divided into three groups, intermediate and primary decoders based on coincidence circuits. The primary decoder consists of a three-dimensional matrix of three-input coincidence circuits. The new organization of the distributor increases its economy by reducing the total number of coincidence circuits in the intermediate decoders, and decreases the dimensions while preserving the same number of channels and convenience of installation. A block diagram and photograph of the device are presented, and its operation is described. It is constructed entirely of integrated microcircuits: the counters consist of type K1TK551 flip-flops, the intermediate decoders of type K1LB3012 NAND gates and K1LB556 elements (used as inverters with high load capacity), the primary matrix is based on type K1LB3012 and K1LB3011 elements. The printed circuit boards are stacked. The pulse distributor measures 100 x 100 x 40 mm, weighs 250 g, consumes 7 W of power, switching pulse frequency is 10 mHz, power of output pulses on channels is 1.25 mW, output pulse amplitude 3.5 V. Figures 2; tables 1; references: 1 Russian.

EAST GERMANY

STRUCTURAL FEATURES OF MINICOMPUTERS AND MICROCOMPUTERS

East Berlin NACHRICHTENTECHNIK ELEKTRONIK in German Vol 27, No 2, 1977
pp 51-53 manuscript received 20 Sep 76

KOEHLER, V., Information Technology Section, Karl-Marx-Stadt Technical College

[Abstract] The structural features distinguishing minicomputers and microcomputers are briefly reviewed. Insofar as size is concerned, microcomputers are smaller, requiring only LSI circuits and electronic units capable of being accommodated on a circuit board; minicomputers require more space (versions fitting a 19-inch rack are common). The price of an average microcomputer is about one fourth of that of an average minicomputer. The operating memory of a microcomputer is up to 16 K words; of a minicomputer, up to 256 K words (the word lengths are up to 16 bit and up to 24 bit, respectively). Microcomputers are usually controlled with microprograms; minicomputers often feature follower controls also. The working cycles are 0.5 to 2 μ sec for a minicomputer and 2 to 20 μ sec for a microcomputer. Minicomputers may be programmed by assembler and compiler; in microcomputers, there is usually insufficient capacity for an assembler. Microcomputers have a more limited application range than minicomputers; while the latter may be used for a large variety of purposes, the former are used primarily in control, conversion, data processing, metrology, and the like. Microprocessors may be regarded as programmable logic units of high reliability. Figures 3; tables 1; references 3: German.

EAST GERMANY

THE U 808 D MICROPROCESSOR. PART 2 (CONCLUSION)

East Berlin RADIO FERNSEHEN ELEKTRONIK in German Vol 26, No 6, 1977
pp 187-188, 197-198

HOEHNE, MICHAEL, graduate engineer, Radio Works Combine State Enterprise, Erfurt

[Abstract] External control signals for the microprocessor are two timing pulse signals, the INTERRUPT signal (permits program interruption and leaving the STOP state), and the READY signal. The microprocessor has three inputs, four outputs and eight input/output stages. The U 808 D is the central processor of a microcomputer [Mikrorechner], which consists in addition to the microprocessor (with timing pulse generator, bus driver, address register, input multiplexer, control logic, and address switching unit for the DMA [direct memory access] store), of a program store, data store, input/output devices, and auxiliary logic. The block diagram of the microcomputer is presented and explained. The components of the microcomputer may vary so

that the system may be adapted to a wide variety of uses. All data, address, and control buses connected to the microcomputer must have tri-state outputs; all units except the program and data store must be designed as TTL devices. Those TTL circuits which are connected directly to the outputs of the central processor must have low-power TTL parameters at their inputs. Figures 10; tables 9; references: 4 German.

Certain Aspects of Photography and Television

USSR

UDC 528.7:778.35:522.61:771.534:531.:429:621.391:681.515.8

CONCERNING AN AUTOMATED IMAGE PROCESSING SYSTEM

Novosibirsk AVTOMETRIYA in Russian No 3, 1977 pp 6-12 manuscript received
2 Feb 77

NESTERIKHIN, YU. YE. and PUSHNOY, B. M., Novosibirsk

[Abstract] On the basis of the information redundancy inherent in images, general requirements are developed for an automated image processing system. The parameters of the "Zenit" photogrammetric automat are given, a prototype of which was made and tested at the Institute for Automatics and Electrometry of the Siberian Department of the USSR Academy of Sciences. The results of test operation of the "Zenit" system are discussed and recommendations are given for future systems. These include: 1) Increasing the maximum image format from 300 x 300 mm² to 450 x 450 mm², because in many cases it is necessary to process jointly several images; 2) The "Minsk-22" computer exhibited a clearly inadequate operational speed for the solution of even uncomplicated image processing problems, a defect which was manifest in the considerable amount of work involved in debugging the algorithms; and 3) Because the time for shifting the read beam from point to point and measuring the optical density can be reduced to a few microseconds, and the data communications channel should provide for approximately the same exchange rate, byte exchange is unsatisfactory and complete word interchange is required. The practical problems to be solved with such a system are algorithmically complex, and this requires the development of a debugging mode in the form of an operator/system dialog. A special half-tone display with a multi-function light pen is needed. A minicomputer is indispensable for the debugging and preventive maintenance of the photogrammetric automat. For the solution of complex problems, the system should be expanded by interfacing a large computer (the M-4030), graph plotters, storage CRT displays, and other items. All of these considerations are the basis for the development of the new "Zenit-2," which is presently underway at this institute. The configuration of the system is illustrated by a block diagram. Figures 1.

USSR

UDC 621.391:681.3.01

COMPOSITION OF THE SOFTWARE FOR THE "ZENIT" PHOTOGRAMMETRIC AUTOMAT

Novosibirsk AVTOMETRIYA in Russian No 3, 1977 pp 52-57 manuscript received
28 Jan 77

VORONTSOVA, L. A. and CHEYDO, G. P., Novosibirsk

[Abstract] The software for the operation of the computer controlled "Zenit" photogrammetric automat can be broken down into three parts, according to function: systemic, metrological and special software. The systemic

software organizes the interfacing of the computer with the unit which generates the control and service programs, provides for convenient storage and rapid starting of the working routines, as well as the resulting translations from the FORTRAN and "Makrakod" languages. The metrological software is a specialized portion of the overall software which is responsible for maintaining the metrological parameters of the photogrammetric automat at a high level; this includes test and calibration programs, intended for checking the interactions of the primary units and the measurement of the most important metrological parameters required in drawing the system of coordinates. The existence of two independent system readout coordinates in the "Zenit," that for the scanning system and the one for the laser interferometers, place special requirements on the metrological software as regards interfacing these readout systems, their calibration, error compensation and accuracy analysis. The specialized software is a developed portion of the overall software which consists of algorithms for the solution of specific image processing problems for various fields of science and engineering: algorithms have been developed for the automatic measurement of star image coordinates on astronomical negatives and the stellar magnitudes, for tracing linear images, and for the automatic processing of cytological preparates. A method is proposed to compensate for the nonlinearity of the measurement guides, based on the readings of the laser interferometers, which does not require using external straight line calibrating standards. Figures 4; tables 1; references: 2 Russian.

USSR

UDC 621.3.087:681.3

PROGRAM CONTROLLED MODULES OF THE INTERFEROMETRIC COORDINATE MEASUREMENT SYSTEM OF THE "ZENIT" PHOTOGRAMMETRIC AUTOMAT

Novosibirsk AVTOMETRIYA in Russian No 3, 1977 pp 24-33 manuscript received 13 Jan 77

AL'KAYEV, M. I., VEDERNIKOV, V. M. and SHCHERBACHENKO, A. M., Novosibirsk

[Abstract] A combination of a mechanical system for the transport of a flat photographic carrier and an electronic optical system with a CRT is used in the "Zenit" photogrammetric automat. Two laser interferometers serve as travel transducers. Measurement of the coordinates of the carriage which supports the corner reflectors for position measurement, control of the carriage motion, positioning of the beam of the CRT, measurement of the optical density at the selected point and control of the illumination intensity of the photographic material are accomplished by the program controlled modules on instructions from a "Minsk-22" computer through a specially designed controller. The theory and operation of this controller and the modules are described. A count pulse driver module amplifies the signals of the photoelectric pickups of the laser interferometer, converts them to a series of rectangular waveforms and generates the signals for the direction of carriage travel. A bidirectional counter module converts the

magnitudes of carriage travel into a 24-digit binary code and stores the on-going values of the coordinates. An electric motor control module acts as a signal driver for the electric motor control signals in the "carriage positioning" and "constant speed carriage travel" modes. The argon laser modulator control module is the driver for the pulse or voltage signal for the control of the laser beam intensity modulator. Figures 7; tables 2; references: 6 Russian.

USSR

UDC 681.327.521

THE SCANNING UNIT OF THE "ZENIT" ALL-PURPOSE PHOTOGRAMMETRIC AUTOMAT

Novosibirsk AVTOMETRIYA in Russian No 3, 1977 pp 19-24 manuscript received 31 Dec 76

MAMONTOV, G. M., POTASHNIKOV, A. K., and SITNIKOV, G. F., Novosibirsk

[Abstract] The theory and operation of the scanner for the "Zenit" photogrammetric automat are described. The scanner is designed around a high resolution CRT to solve the following problems: more complete automation of the processing of image fragments; higher spatial resolution, sufficient for the processing of objects on the order of 10 micrometers; and automated measurement of the dark density of the emulsion layer of a photographic plate. The scanner consists of a digital logic block, a scanning unit and a dual beam photometric block. Using interchangeable objective lenses the working field of $40 \times 40 \text{ mm}^2$ on the CRT screen is reduced in the plane of the photographic carrier to the size required for the specific task, the minimum area being $500 \times 500 \text{ }\mu\text{m}^2$. The effective diameter of the light spot in the plane of a photographic plate can be brought down to around 3 - 5 micrometers. The transmittance factor is quantized into 128 levels, and the operational speed in the search mode is 100,000 points per second. The number of addressable points is $4,096 \times 4,096$ and the instability in the scanning pattern is 0.1 percent. The operation of the device, the optical channel and the photometric unit are illustrated. Figures 5.

USSR

UDC 681.513.52:681.515.8

THE ELECTROMECHANICAL POSITIONING SYSTEM OF THE "ZENIT" PHOTOGRAMMETRIC AUTOMAT

Novosibirsk AVTOMETRIYA in Russian No 3, 1977 pp 12-19 manuscript received 17 Jan 77

BURYY, L. V., KUZNETSOV, S. A., LUGOVOV, L. G., NESTEROV, A. A., and PUSHNOY, B. M., Novosibirsk

[Abstract] The positioning system of the "Zenit" photogrammetric automat is described. The frame supporting the photographic material is driven by

an electric motor with a printed circuit rotor through flexible steel tape links, and moves in two coordinates. The linear travels involved are measured by two independent laser meters. The flexible steel driving tapes are designed to provide for automatic variations in tape tension as a function of the transmitted force. The speed controller contains a control unit which is optimized with respect to the operational speed and which moves the frame at a speed on the order of 1 m/sec. In the maximum travel range of 300 mm in each coordinate, the positioning error is 0.16 mm. A second, precision positioning stage contains a proportional controller and achieves positioning with an error of one discrete step of a laser travel meter, which is 0.32 micrometers. The theory underlying the unit and its application are illustrated. Figures 4; references: 5 Russian.

USSR

UDC 621.391:681.3.01

THE AUTOMATION OF ASTRONOMICAL AND PHOTOMETRIC MEASUREMENTS

Novosibirsk AVTOMETRIYA in Russian No 3, 1977 pp 88-98 manuscript received 27 Dec 76

KOSYKH, V. P. and CHEYDO, G. P., Novosibirsk

[Abstract] The problem of automatically measuring the coordinates of star images on astronomical negatives, and the stellar magnitudes, is solved by use of the "Zenit" photogrammetric automat in conjunction with a computer. The proposed system completely automates the process as opposed to the previous "Ascorecord," which is semiautomated and clearly insufficient for processing of the already existing enormous archives of plates as well as the new negatives being made. A mathematical treatment of the problem of coordinate and photometric measurements is followed by a discussion of experimental results. The resulting program was used to process a series of astronomical negatives obtained with the 26-inch reflector at Pulkovo Observatory. The results are presented in tabular form for the following quantities: background level, mean square deviation of the noise (granularity plus the scanning system noise), average value, ρ , of the measured distances between the components of a double star on a given plate, and the mean square deviation in ρ , as well as the dependence of the precision of the coordinate evaluations on the threshold level. The values of the mean square deviation in ρ fell within a range of 1.12 - 2.5 micrometers. The ability to use the instrument for photometric measurements was studied by measuring the dimensions of star images of the 12th - 16th magnitudes from the scattered globular cluster, NGC 7790. The results indicate that by using a calibration curve plotted for 32 stars, it is possible to determine stellar magnitudes with an accuracy of no worse than 0.1. Figures 7; tables 2; references: 3 Russian.

USSR

UDC 621.391:681.3.01

THE RESTORATION OF THE DIMENSIONS OF MICROSCOPIC OBJECTS WHEN THEY ARE READ THROUGH A FINITE APERTURE

Novosibirsk AVTOMETRIYA in Russian No 3, 1977 pp 108-114 manuscript received 18 Jan 77

KIRICHUK, V. S. and KOSYKH, V. P., Novosibirsk

[Abstract] In problems which involve fine analysis of microscopic objects when reading their images and subsequently processing them on a computer, it is necessary to deal with the situation where the dimensions of the reading aperture are of the same order of magnitude as the object dimensions. This situation arises when using the "Zenit" photogrammetric automat, with a scanning spot diameter on the order of a few microns. This causes the extension of the edge of contrast images, because in order to measure the dimensions of the objects and localize their edges, the influence of the finite size of the spot must be taken into account. This problem can be resolved by solving the classical inverse problem using continuous scanning and subsequent numerical solution of the resulting integral equation. A simpler solution is proposed here for the processing of two-tone images of a simple shape. The measurement of the dimensions of contrasting circular microscopic objects is treated. The images are read in accordance with an adaptive algorithm, where the trajectory of motion for the reading beam is determined by the image being analyzed. Instead of solving the inverse problem, a simple measurement procedure is used with subsequent correction of the results. The algorithm derived is used to determine the dimensional distribution of metal spheres with an average diameter of 7 micrometers. The area of the spheres was measured, and then recomputed for the geometric dimensions of the particles and corrected. A histogram showing the distribution of the dimensions of the spheres is provided, which was derived from the results of measuring $5 \cdot 10^3$ particles. The random error in the area measurement does not exceed 2.5 percent, where the relative error decreases with an increase in the object area. The error in the determination of the dimensions is twice as small, and the mean square deviation of the error in the radius of the particles is 1 - 1.2 percent. Figures 4; tables 2; references: 3 Russian.

USSR

UDC 621.391:681.3.01

THE FORMULATION OF PROCEDURES FOR THE READING OF IMAGES WITH CONVEX BOUNDARIES

Novosibirsk AVTOMETRIYA in Russian No 3, 1977 pp 65-74 manuscript received 31 Dec 76

KIRICHUK, V. S., PUSHNOY, B. M. and CHEYDO, G. P., Novosibirsk

[Abstract] A simple procedure for reading "compact" images with convex boundaries (e.g., stars on astronomical photographic negatives, cell

populations in biology) using the "Zenit" photogrammetric automat is proposed. The algorithm for automated image processing searches out, localizes and rejects each object in a specified zone. The zone is covered with a regular grid with a spacing of no more than $\sqrt{d_{\min}}$, where $d_{\min}$ is the size of the smallest object to be processed. The sampling, which is carried out along the lines of this grid, produces the initial data for the image analysis. Because as a rule images and microscopic objects make a smooth transition to the background, and noise in the read channel makes the object boundary even more indeterminate, the use of complex statistical criteria for the isolation of the image boundary is impermissible because of the large computational times. The distribution of the image boundary points is studied, and relationships which characterize the statistical parameters involved are derived. These have the sense of sampling moments of the image. The mathematical treatment yields read procedures for compact images which are effective and have simple algorithms for isolating the boundaries, which provide a high processing speed and evaluation precision. Figures 7; tables 1; references: 5 Russian.

USSR

UDC 513.06:621.391:681.3.01

THE AUTOMATIC ANALYSIS OF CYTOGRAMS

Novosibirsk AVTOMETRIYA in Russian No 3, 1977 pp 98-107 manuscript received 27 Dec 76

ANDRIANOV, L. A., KIRICHUK, V. S., KOSYKH, V. P. and CHEYDO, G. P.,
Novosibirsk

[Abstract] Cytological analysis using the "Zenit" system produced results reflecting the initial stage in a search directed towards the development of modern methods of oncological diagnosis based on the automated analysis of cytological preparates. The characteristics of nuclei derived using a "Zenit" type system are compared with the characteristics of nuclei used in substantiations of a cytological diagnosis. For example, the magnitudes of nuclei for normal and changed cells can be compared with much greater precision by the system than by a person. The following parameters of cell nuclei were determined in this research: The coordinates of the center, the area, the maximum and minimum radii, the orientation of the maximum and minimum radii, the distribution of the integral transmittance as a function of the selected threshold, the radius of inertia of a nucleus and the perimeter of the nucleus. The algorithm for determining all of these parameters results in a system capable of the complete analysis of cell nuclei in 5-6 seconds with 300-500 measurements of the transmittance factor per nucleus (these data apply to the system with the "Minsk-22" computer, which is presently being replaced by the five to six times more productive M-4030). The processing of a series of cytological preparates demonstrated that the "Zenit" system permits the measurement of a large set of diverse parameters of cells and nuclei with an accuracy adequate for determining the criteria which characterize the composition and functional condition of cells in a preparate.

An advantage of the system is that the results of the measurements are fed directly into the computer; the high productivity of the system also permits setting up criteria based on an analysis of large samples; in this case, it is possible to determine reliably small concentrations of changed elements. This capability is one of the requisite conditions for the early diagnosis of tumoral diseases. Figures 14; references: 5 Russian, 2 English.

USSR

UDC 61.395.657.3

OPERATING-TIME REGULATION OF MUTUALLY INTERFERING RADIO COMMUNICATION SYSTEMS

Kiev IZV.VUZ:RADIOELEKTRONIKA in Russian Vol 20, No 7, Jul 77 pp 106-108
manuscript received 8 Jul 75; after revision, 25 Oct 76

SILIN, A. V.

[Abstract] The electromagnetic compatibility of a group of radio communication systems generally depends both on the individual characteristics of each system and on the coupling between the systems in the group. The former are usually all set and the possibility of adjusting the latter is limited, especially when some systems within the group are incompatible for simultaneous operation. The need then arises for a regulatory agent, namely a dispatch center, to control the operation time of these systems. The structure of such a center is described in terms of Boolean variables. A simple group of N radio systems is considered, each consisting of a unidirectional communication link between one transmitter and one receiver. The entry of i -th line into service ($Y_i=1$) must proceed through the dispatch center ($X_i=1$) and only if the level of interference in the i -th receiver is below the receptivity threshold of the latter ($Z_i=1$). References 2: 1 Russian; 1 Western.

USSR

UDC 621.372.2.029.7

PROPAGATION OF MODULATED WAVES THROUGH A TURBULENT ATMOSPHERE. DISPERSION OF PHASE FLUCTUATIONS IN THE MODULATING OSCILLATION

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 22, No 9, Sep 77 pp 1965-1969 manuscript received 19 Apr 76

LUKIN, V. P. and LUKIN, I. P.

[Abstract] Distortion of laser beams in a turbulent atmosphere is one of the factors determining their applicability to communication systems. Fluctuations of a phase signal transmitted along an optical communication line by means of boosting amplitude modulation are analyzed here, considering that a practical laser is not an ideally monochromatic source. The dispersion of fluctuations in the modulating oscillation is expressed in terms of correlation functions of the complex phase, for a Gaussian beam propagating through a randomly non-homogeneous medium. Further calculations are made only for the extreme cases of a plane wave and a spherical wave. References 6: 5 Russian, 1 Western.

EAST GERMANY

INSTRUMENT SYSTEMS IN COMMUNICATIONS ENGINEERING. METHOD FOR CALCULATING
GLASS-FIBER LIGHT WAVE CONDUCTORS

East Berlin NACHRICHTENTECHNIK ELEKTRONIK in German Vol 27, No 2, 1977
pp 67-69 manuscript received 20 Sep 76

NOWAK, W., Dresden Technical University, Section 9, Area 1

[Abstract] The geometric-optical approach is inadequate for proper designing of glass-fiber light-wave conductors, especially those of the multimode, core-mantle fiber type. In the strict wave-optical approach, we deal with dielectric surface wave conductors; for the core-mantle fiber types we have the solutions of the vectorial Helmholtz equation. The strict wave-optical solution is also suitable for the single-mode fiber type. But this method is quite complex, especially for multimode, core-mantle fiber types. In many instances, especially if the axial angles of the gradient fibers are relatively small, a scalar approximation is permissible. The Helmholtz scalar equation is useful here. The quasi-Cartesian approach, in which the right-angle components of the wave vector are used for every point, may often be used with success. In this approach, we may use the guided leak-mode approach or the WKB method known from the solution of the Schroedinger equation. If neither of these approaches are feasible, we must employ numerical methods. The advantage of the vectorial solution is that it contains no systematic approximations, so that if the step size is small, any desired degree of accuracy may be achieved. Figures 3; tables 1; references 8: 3 German; 5 Western.

USSR

UDC 621.383.202.001.5

ESTIMATING THE ARRIVAL TIME OF A WEAK OPTICAL SIGNAL WITH THE AID OF A PHOTOELECTRON MULTIPLIER

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 22, No 9, Sep 77 pp 1998-2002 manuscript received 26 Mar 76

SHUBNIKOV, YE. I.

[Abstract] An optimum receiver has been constructed, and the dispersion of the effective estimate of the arrival time of a weak optical signal, with a Poisson distribution of the photocurrent, was determined earlier for the case of an ideal photodetector. In the present work the accuracy of that estimate is considered for a weak optical signal arriving at an incoherent receiver with various linear filters and a real photodetector. The output signal is processed either by differentiation of the voltage or integration of the current, and thus the zero-crossover point is determined or by recording the zero-crossover of the leading pulse edge. An optimal filter is one which extracts the "center of gravity" of the signal, which can be achieved with a variable threshold which tracks this "center of gravity" on the basis of the stored charge at the photomultiplier output. Consequently, in recording the arrival time of a weak optical signal, one must consider not only the quantum nature of such a signal but also the time period and amplitude fluctuations in the photoreceiver. Figures 4; references: 4 Russian.

USSR

UDC 621.391.16

NOISE IMMUNITY OF RECEPTION OF OPTICAL SIGNALS WITH AN ACTIVE PAUSE UNDER TURBULENT ATMOSPHERIC CONDITIONS

Moscow RADIOTEKHNIKA in Russian Vol 32, No 10, Oct 77 pp 84-85 manuscript received 13 Sep 76

TOLPAREV, R. G. and POLYAKOV, V. A.

[Abstract] A distinct feature of atmospheric communication channels is a slow fluctuation of the mean number of signal photons at the input of an optical receiver. The dispersion of the number of these signal photons characterizes the level of atmospheric turbulence. The noise immunity of reception of optical signals which is attainable when a coherent signal in ambient thermal noise is received with an equiprobable transmission of binary signals must, therefore, be corrected for the effect of atmospheric turbulence on the mean error. Calculations have shown that the transmitter power must be increased about 25 times to reduce the resultant error probability to 10^{-7} under conditions of high turbulence (dispersion of the number of signal photons $\sigma^2 = 2.56$). Figures 1; references: 3 Russian.

USSR

UDC 621.391.63.029.7

LIGHT PROPAGATION THROUGH A LARGE-APERTURE BRAID OF HOMOGENEOUS GLASS FIBERS
CONSTRAINED BY A HELIX OF METALLIC OR GLASS FILAMENT

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 22, No 9, Sep 77 pp 1875-
1882 manuscript received 7 Dec 76

AFANAS'YEVA, T. B. and KATSENELEBAUM, B. Z.

[Abstract] Homogeneous glass fibers have a large aperture, but light cannot be confined inside them without a protective sheath contacting such fibers along the entire path. The attendant losses in such a sheath can be reduced by insertion of sparse spacers between fiber and sheath. A braid of fibers is considered here consisting of several identical cylindrical fibers helically constrained for this purpose by a metallic or glass filament. The energy lost by an array of light beams propagating through such a braid is analyzed statistically, with the wavelength of light assumed to be very much smaller than both the radius of a fiber and the variance of the helix pitch. The analysis is thus not affected by the discreteness of all possible light beam orientations and by the periodicity of the helix-to-fiber contact. The wave nature of light affects only the process of crossing the air tunnel near a contact between fiber and helix. The results of this analysis indicate that the energy loss in the helix is proportional to the distance and the mean angle between light beam and helix axis is inversely proportional to the square root of the distance. Numerical calculations have been made for both an aluminum helix and a glass helix. The results are compared with those obtained with arrays of rings of the same materials. Figures 4; tables 1; references: 4 Western.

USSR

UDC 538.56:519.25

STATISTICS OF RAYS IN MULTIMODE-IRREGULAR OPTICAL FIBERS

Gor'kiy IZV.VUZ:RADIOFIZIKA in Russian Vol 20, No 8, 1977 pp 1153-1164
manuscript received 21 May 76

SHATROV, A. D., Institute of Radio Engineering and Electronics, Academy of
Sciences, USSR

[Abstract] A study is made of a two-dimensional wave guide medium with index of refraction $n(x,z)$, but the method can be easily expanded to the three-dimensional problem $n(x,y,z)$. The ray is characterized by its coordinates and pulses. A pulse p is defined as a factor tangential to the trajectory of the ray, $|p| = n$. Equations are produced which determine the probability distribution of space and time characteristics of the rays. Diffusion equations are derived which allow the distribution density of rays to be calculated, and thus to determine power losses, the ray structure of the field

at the output of a fiber and the distribution of optical path length of rays, and consequently, the shape of a pulse signal at the output. The author thanks B. Z. Katsenelenbaum and R. F. Matveyev for many useful discussions. References 16: 10 Russian; 6 Western.

USSR

UDC 621.391:519.25

RANK DETECTION OF AN OPTICAL SIGNAL

Kiev IZV.VUZ:RADIOELEKTRONIKA in Russian Vol 20, No 7, Jul 77 pp 29-35
manuscript received 3 May 76

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

[Abstract] Nonparametric detection is almost as powerful as, but more reliable than, classical detection, because of the invariance of false-alarm probability with respect to changing noise modes and parameter distributions. Wilkinson's rank criterion seems most effective for such detection. Accordingly, the model of such a detector operating with optical signals is analyzed and its advantages over an optimal detector, including negligible instrument losses, are brought out. Figures 5; references 6: 4 Russian; 2 Western.

USSR

UDC 621.396.963.3

A DEVICE FOR DETECTING OPTICAL SIGNALS SUBMERGED IN AMBIENT PULSE NOISE

Leningrad IZV.VUZ:PRIBOROSTROYENIYE in Russian Vol 20, No 7, Jul 77 pp 81-85
manuscript received 24 Sep 76

VIKTOROV, L. V., MIKHAMEDYAROV, R. D., and NESTERNKO, O. I. Paper recommended by Chair of Experimental Physics, Ural Polytechnic Institute imeni S. M. Kirov

[Abstract] A device is proposed for detection of optical signals by the Neumann-Pierson criterion. It consists of a matched filter connected through a high-speed threshold circuit to a coincidence circuit. The filter input is also connected to the second input of the coincidence circuit through an amplifier-limiter on a Schmitt trigger, a delay line, a differentiating circuit, and a shaper of short readout pulses. The performance of this system is analyzed relative to that of a linear receiver containing only a matched filter and a threshold circuit. The results of such a comparative evaluation indicate that, while more effective than a linear detector of optical signals submerged in multielectron noise pulses, the proposed device is less effective than an optimal photon-counting detector. However, its practical design is much simpler than that of an optimal detector. It is

also immune to overloading when exposed to a higher phonon power and, with the amplitude distribution of noise becoming normal, it becomes a nearly optimal detector. Figures 3; references 7: 6 Russian; 1 Western.

USSR

UDC 621.372.55

CORRECTING THE SHAPE OF PULSE SIGNALS TRANSMITTED THROUGH A COAXIAL CABLE

Moscow RADIOTEKHNIKA in Russian Vol 32, No 9, Sep 77 pp 50-55 manuscript received 29 Dec 75; after completion, 21 Dec 76

VERETENNIKOV, A. I., DOVZHENKO, O. I., SEMENOV, S. F., and YANKOV, V. V.

[Abstract] The original shape of electric pulses distorted during their transmission through a coaxial cable is determined analytically so that a reasonable degree of correction with a controllable error becomes possible without the use of special numerical methods. The pulse characteristic of a coaxial cable, ideally without dielectric losses and without attenuation of d.c. signals, is defined as a function of time t and the longitudinal space coordinate x , analogous to that of a binary heat source in the equation of one-dimensional heat conduction along a semi-infinitely long line without initial conditions and with one boundary condition of the first kind. The problem is now solved by a sequential series representation of the signal function in terms of both variables. Figures 3; references 19: 11 Russian; 8 Western.

USSR

NEW METHODS OF MOUNTING PROTECTIVE COVERS ON HIGH-FREQUENCY COMMUNICATION CABLES BY MEANS OF THERMO-SHRINKING FITTINGS

Moscow VESTNIK SVYAZI in Russian No 9, 1977 pp 23-24

PROMYSLOV, A. S., leading engineer, and KUZ'MIN, senior engineer, TsNIIS [Control Scientific-Research Institute of Communications]

[Abstract] One method of making connections of high-frequency communication cables includes the use of tubing made out of a material which shrinks radially and axially when heated to 150-180°C. This tubing serves as protective cover for the connection. Adhesive coating on the inner surface of the tubing is provided in order to assure a water-tight joint. Recommendations are made with respect to the amount of clearance before and the interference after the shrinkage, as well as the axial overlap with the cables. Drawings of three typical connector arrangements are presented.

A connector of this type was subjected to 50 cycles of temperature varying from -50°C to $+50^{\circ}\text{C}$ and then submerged in water for 500 days. This did not affect the insulation resistance. Figures 4; tables 2.

USSR

UDC 621.372.81

METHOD OF CALCULATION OF THE PARAMETERS OF HETEROGENEITIES IN MICROWAVE TRANSMISSION LINES BY MEANS OF A FOURIER TRANSFORM

Moscow IZV-VUZ:RADIOELEKTRONIKA in Russian Vol 20, No 8, Aug 77 pp 31-35
manuscript received 21 Apr 76; after revision, 19 Oct 76

KUKUSHKIN, A. V. and RAYEVSKIY, S. B.

[Abstract] A method is described for determining the coordinates and nature of heterogeneities in microwave transmission lines by means of a reverse Fourier transform of the measures S-parameters of these lines. A theoretical study of the accuracy of location of heterogeneities by this method is conducted. The method is universal, i.e., equally suitable for dispersed and nondispersed lines. Figures 2; references 10: 6 Russian; 4 Western.

USSR

UDC 621.372.85

DISPERSION DEVICE WITH ADJUSTABLE STEEPNESS OF GROUP DELAY CHARACTERISTIC

Moscow IZV.VUZ:RADIOELEKTRONIKA in Russian Vol 20, No 8, Aug 77 pp 114-117
manuscript received 15 Jul 76

KIRYUKHIN, A. M., ZHUKOV, V. A. and ROGACHEV, V. I.

[Abstract] The dispersion device with adjustable steepness of the linear group delay characteristic is based on the property of second power parabolic functions that the sum of two parabolas differing only in direction of branches and coordinates of peaks is a straight line, the slope of which is determined by the relative displacement of the parabolas along the abscissa. The basic elements of the device are two delay lines with parabolic dispersion characteristics. Regulation of the steepness of the resulting linear group delay characteristic of the device is achieved by retuning the frequency of the beat-frequency oscillator. Figures 1; references: 5 Russian.

USSR

UDC 621.376.56;621.397:519.25

A STATISTICAL MODEL OF A DIGITAL IMAGE SIGNAL

Moscow RADIOTEKHNIKA in Russian Vol 32, No 10, Oct 77 pp 8-15 manuscript received 15 Aug 76

KOGAN, S. S.

[Abstract] A successful design of communication systems which transmit image signals in digital form requires a statistical model. The basic statistical characteristics established here for an image signal at the output of an analog-to-digital converter in a pulse-code-modulation system are the probability of a "1" appearing in any position within a code group and the value of the autocorrelation function for code pulses distributed within a code group, for code pulses in the same position within two adjacent code groups, or for code pulses in different positions within adjacent code groups. The properties of the probability matrix pertaining to transitions from one level to another are illustrated here, using the Gray code. A digital image signal is found to be representable as a sum of independent random pulse sequences which, depending on the length of the time interval between them, correspond to various Markov chains. The energy spectra of these sequences and of a digital image signal are also calculated here. Figures 2; references 7: Russian; 3 Western.

USSR

UDC 621.391

NONOPTIMAL DETECTION OF A DETERMINISTIC SIGNAL SUBMERGED IN NOISE OF VARYING INTENSITY

Kiev IZV.VUZ:RADIOELEKTRONIKA in Russian Vol 20, No 7, Jul 77 pp 110-113 manuscript received 26 Apr 76

BELOSHITSKIY, A. P.

[Abstract] The theory of optimal detection methods with incomplete a priori information is only in its early stages of development. Consequently, in order to solve various problems in radio reception, it is still important to estimate how much the detection characteristics will deteriorate as a result of non-optimal reception. The receiver considered here detects deterministic signals optimally when the inherent noise has a normal distribution and a uniform spectral density. The object of the analysis is to evaluate the detection characteristics of such a receiver when instabilities in the receiver-amplifier channel cause random variations of the noise power. The resolver is assumed to operate at a threshold level ensuring a mean false-alarm probability so that the latter, as well as correct-detection probability, become random quantities. Such a receiver is found to be suboptimal when detecting a signal submerged in noise of varying intensity, the nonstationarity of noise

making it necessary to reduce the mean false-alarm probability by raising the resolver threshold and thus also reducing the correct-detection probability. Figures 3; references 2: 1 Russian; 1 Western.

USSR

UDC 621.391.832:621.394.44

EFFECT OF AMPLITUDE-TO-PHASE CONVERSION ON THE NOISE IMMUNITY OF THE
RECEPTION OF MULTICHANNEL SIGNALS

Moscow RADIOTEKHNIKA in Russian Vol 32, No 9, Sep 77 pp 80-83 manuscript
received 15 Jan 76

NOSOV, V. I. and ROZOV, V. M.

[Abstract] In many modern communication devices and systems the phase of the output signal depends on the amplitude of the input signal envelope, which results in amplitude-to-phase conversion and thus to stray frequency modulation. The effect on crosstalk and noise immunity is analyzed here, of particular interest being the reception of orthogonal multichannel signals used for transmission of discrete data. The signal-to-noise ratio is calculated analytically, with the number of channels as a parameter, the amplitude-frequency characteristic of the device is assumed to be linear, and the amplitude-phase characteristic approximated by a second-degree polynomial (as in the case of a traveling-wave tube). The theoretical relations are with experimental data pertaining to an envelope detector and a controlled phase shifter, which conforms the validity of this method of analysis. Figures 2; references 17: 13 Russian; 4 Western.

USSR

UDC 621.391

GAME SITUATIONS IN RADIO ENGINEERING SYSTEMS WITH CHANGE OF CARRIER FREQUENCIES

Kiev IZV.VUZ:RADIOELEKTRONIKA in Russian Vol 20, No 7, Jul 77 pp 42-47
manuscript received 26 Mar 76

RODIONOV, YA. G.

[Abstract] Changing the carrier frequency in a radio system is an effective method of reducing interference caused by narrow-band noise. If the noise frequencies happen to change at the same time, then a game situation arises. Such a situation is regarded here as a continuous zero-sum game between two players and strategies are developed according to the minimax principle. The conditions of the problem, i.e., the form of the payoff matrix dictate the strategies, i.e., whether the carrier frequency is changed smoothly or

stepwise. An infinite game and a finite game with a rectangular payoff matrix are considered, as well as a game with complete information known to both opponents about one another and the price of the strategies depending on how fast they can obtain this information. An analysis reveals that the noise power decreases with increasing frequency deviation and, therefore, the noise immunity of a radio system in this game situation will improve with a wider range over which its carrier frequency can be adjusted. References 9: 6 Russian; 3 Western.

USSR

UDC 621.391.2

SPACED RECEPTION WITH SELF-TRAINING IN CHANNELS WITH NOISE CONCENTRATED IN THE SPECTRUM

Moscow IZV.VUZ:RADIOELEKTRONIKA in Russian Vol 20, No 8, Aug 77 pp 40-44
manuscript received 30 Mar 76; after revision, 19 Nov 76

FAL'KO, A. I.

[Abstract] Additive spaced reception is analyzed in channels with concentrated and fluctuating noise. Reception is studied under conditions such that the distribution of the parameters of the signal and the concentrated noise is unknown. The algorithm is based on the principle of replacement of unknown signal parameters and noise parameters with their estimates, while the estimates of the unknown parameters are based on a nonclassified sequence of signals received over a given time interval. The advantage of learning based on a nonclassified learning sample of noise is that the algorithm and the noise resistance of reception are independent of the intensity of the concentrated noise and the rate of change of the parameters of the noise. References: 6 Russian.

USSR

UDC 621.391.2

CORRELATION FUNCTION FOR A NARROW-BAND NORMAL RANDOM PROCESS AFTER AMPLITUDE-TO-PHASE CONVERSION

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 22, No 9, Sep 77 pp 1902-1906
manuscript received 2 Dec 75; after revision, 31 Mar 77

MARESKIN, V. M.

[Abstract] The spectrum-correlational characteristics of narrow-band random processes following an amplitude-to-phase conversion are analyzed in the case where a normal such process acts on a complexly nonlinear device. As an example, the envelope of the correlation factor at the output of an

vth power-law detector is calculated and the energy spectrum of the output process found to widen in the case of a functional relation between phase and amplitude. Figures 1; references: 13 Russian.

USSR

UDC 621.391.26

INVARIANT DETECTION OF ONE AMONG M ORTHOGONAL SIGNALS SUBMERGED IN WHITE GAUSSIAN NOISE OF UNKNOWN POWER

Moscow RADIOTEKHNIKA in Russian Vol 32, No 9, Sep 77 pp 22-27 manuscript received, after completion, to 10 May 76

PROKOF'YEV, V. N.

[Abstract] A feasibility analysis is made of signal detection on the basis of statistical criteria, i.e., rules for testing the detection hypotheses invariant with respect to scale-factor and shift. The problem of detecting one among M orthogonal signals submerged in white Gaussian noise is then solved accordingly for the case of unknown noise power and channel transmission factor (signal level). The algorithm is applied to coherent, incoherent, and Rayleigh channels. The stability (invariance) rules are independent of interfering parameters so that the false-alarm probability does not depend on the noise level and the probability of correct detection remains invariant with respect to the channel transmission factor. References 18: 14 Russian; 1 Czechoslovak; 3 Western.

USSR

UDC 621.391.2

STATISTICAL PROPERTIES OF FREQUENCY-MODULATED DISCRETE COMPOUND FREQUENCY SIGNALS

Moscow RADIOTEKHNIKA in Russian Vol 32, No 9, Sep 77 pp 28-31 manuscript received 7 Jun 76; after revision, 29 Dec 76

VARAKIN, L. YE.

[Abstract] Discrete compound frequency signals are those whose every element also constitutes a compound signal. A characteristic property of frequency-modulated discrete compound signals is the concentration of signal energy within the elements of the outer frequency-time matrix, the latter completely defining the length of a signal and the width of its spectrum. This property can be utilized for fast synchronization in signal reception by the correlation method. The statistical characteristics of the number of coincidences are worse than in the case of discrete plain frequency signals, but the probability of more than one coincidence still remains very low. From the standpoint of

correlational properties, the overall difference between both types of discrete frequency signals is not significant as long as the base remains large, i.e., the signal contains many elements. However the practical advantages of frequency-modulated discrete compound frequency signals are that they can more easily be shaped and more readily used in multichannel reception. Figures 3; references: 3 Russian.

USSR

UDC 621.391.8

SIGNAL-TO-NOISE RATIO AT THE OUTPUT OF NONSTATIONARY FILTERS FOR M-PLY PHASE-KEYSED SIGNALS

Moscow RADIOTEKHNIKA in Russian Vol 32, No 10, Oct 77 pp 91-94 manuscript received 10 May 76; after completion, 20 Jan 77

BUKHARIN, S. V. and BERNSHTEYN, YA. M.

[Abstract] Crosstalk distortions of a phase-keyed signal passing through a selective device slow down the rate of information flow, but they can be corrected effectively by means of nonstationary filters with a variable-gain amplifier at the input. The signal-to-noise ratio at the output of such a filter is calculated here, with a once or m times phase-keyed signal and a white noise at the filter input, also taking into account the possibility of random jumps of the signal phase. The purpose is to determine the time dependence of the amplifier gain which will not only correct the distortions but also yield a higher signal-to-noise ratio than a stationary filter. The analysis indicates that the increase in the signal-to-noise ratio, appreciable in the case of a once phase-keyed signal, becomes smaller here as the number m increases. Figures 1; references 3: 2 Russian; 1 Western.

USSR

UDC 621.391.8

ESTIMATING THE DISPERSION OF A NARROW-BAND NORMAL NOISE FROM THE EXTREMUM STATISTICS OF ITS ENVELOPE

Leningrad IZV.VUZ:PRIBOROSTROYENIYE in Russian Vol 20, No 7, Jul 77 pp 10-12 manuscript received 9 Nov 76

VASIL'YEV, K. K., ZAKHAROV, N. G. and OS'MININ, A. A. Paper recommended by Chair of Basic Radio Engineering Theory, Ul'yanovsk Polytechnic Institute

[Abstract] A random process is considered which results from linear detection of a narrow-band normal noise. The algorithm for estimating the dispersion of this noise can be often simplified by using $t_s = \sup^2 x_i / 4 \left(\sum_{k=1}^n 1/k \right)^2$ as the

valid unbiased estimator of σ^2 . This is proved here, and the advantage of using t_S instead of $t_0 = \frac{1}{2n} \sum_{i=1}^n x_i^2$ especially for a small number of readings x_i is demonstrated. Figures 2; references: 2 Russian.

USSR

UDC 621.391.8

DETECTION OF A COMPLEX SIGNAL WITH POSTDETECTION STORAGE

Kiev IZV.VUZ:RADIOELEKTRONIKA in Russian Vol 20, No 7, Jul 77 pp 59-63
manuscript received 26Apr 76; after revision, 5 Jun 76

VLASOV, V. N. and KOLOSOV, A. V.

[Abstract] Modern radio receivers must detect a complex signal with incomplete a priori information about its parameters. Particularly detrimental to the detection process are side lobes of the autocorrelation functions. The effect of these side lobes on the quality indicators (false-alarm and correct-detection probabilities) of detectors with postdetection storage is analyzed, with an additive mixture of stationary normal white noise of a given spectral density and a useful signal of unknown intensity but given effective spectral width appearing at the input. A one-channel detector is considered first and then a two-channel detector, with the second channel for correlational processing of a second complex signal orthogonal to the first. The gains of both detectors at the threshold level are calculated and compared. The advantage of the given two-channel detector over a one-channel detector is found to increase as $M \rightarrow \infty$ with $k > 1$. Figures 4; references: 4 Russian.

USSR

UDC 621.391.82

STATISTICAL CHARACTERISTICS OF SYNCHRONIZATION IN INTEGRAL COMMUNICATION NETWORKS

Moscow RADIOTEKHNIKA in Russian Vol 32, No 9, Sep 77 pp 42-49 manuscript received 26 Dec 74; after completion, 10 Jun 76

KAYATSKAS, A. A. and RIMAS, I. Z.

[Abstract] Systems of mutually synchronizable time-base generators can be used for matching the speeds of digital data flow generation and switching in integrated-circuit integral communication networks. The performance of such systems is largely affected by random perturbations: fluctuations of their natural frequencies, phase flicker in the pulse-code-modulation

channels, and noise in the return channels. These three effects on the frequencies of time-base oscillations and on the phase differences at the phase detector inputs are analyzed in terms of six appropriate matrices of transient pulse response functions. The results of calculations, presented graphically in the form of dispersion characteristics and normalized correlation characteristics, indicate that an unrestricted increase of the number of generators in a fully coupled network will limit the dispersion of frequencies and phase differences. Figures 5; references 7: 3 Russian; 4 Western.

USSR

UDC 621.395.147

FIDELITY CONTROL IN CHANNELS WITH TRANSIENT NOISE AND SIGNALS

Moscow RADIOTEKHNIKA in Russian Vol 32, No 9, Sep 77 pp 86-89 manuscript received 19 Jun 73; after completion, 21 Feb 77

ZHIGORA, P. P. and RYSHKOV, YU. P.

[Abstract] A method is shown of removing the indeterminacy from a fidelity estimate in a binary symmetric channel transmitting discrete data with transient noise. The method is based on threshold adaptation, with respect to either the signal or the noise, in a control channel connected to the receiver output in parallel with the information channel. The error probability in the latter channel can thus be uniquely evaluated from an automatic regulation of the signal threshold and a measurement, simultaneously with reception, of the frequency of erasure signals in the control channel. A device implementing this method has also been designed for use with a receiver connected to an optimal information channel. Figures 3; tables 1; references: 2 Russian.

USSR

UDC 621.396.668

DISTRIBUTION FUNCTION OF AUTOMATIC-TUNING TIME

Moscow RADIOTEKHNIKA in Russian Vol 32, No 10, Oct 77 pp 4-7 manuscript received 18 Jan 77, after completion

REMBOVSKIY, A. M.

[Abstract] Digital systems of automatic frequency control are used for tuning a system to a narrow-band signal which has been frequency modulated by a random process. Loss of information can be eliminated by minimizing the length of time from the instant of signal detection to the end of the tuning

process. This problem is analyzed here on the basis of characterization of the tuning time by a distribution function, which serves as the criterion of optimum system design. One signal is assumed to fall within the tuning range, its center frequency coinciding with one of the M frequencies of the discretely tuned system. Accordingly, expressions are derived for calculating the statistical performance indicators of the given discrete tuning method. Figures 2; references: 4 Russian.

USSR

UDC 656.254.15.3

A DEVICE FOR CHECKING AUTOMATED COMMUNICATION CHANNELS

Moscow AVTOMATIKA, TELEMEXHANIKA I SVYAZ' in Russian No 2, 1977 pp 3-5

ZDOROVTSOV, I. A., chief designer, Design Bureau of Main Administration for Signals and Communications, Railroad Ministry and POPOV, N. P., leading [Vedushchiy] designer

[Abstract] A description and photograph are presented of a channel checker for automated communication channels which meets the requirements of the railroad communication network. The device, designed at the Design Bureau of the Main Administration for Signalling and Communications of the Railroad Ministry, is portable and small, and is called the UPK - 1. It is multi-purpose and can be used in switching stations with both stepping and coordinate type automatic exchange equipment, and its use requires no additional work related to switching channels and long-distance dialing sets. It allows automatic testing of exchange control signal transmission and testing of residual attenuation of communication channels in both transmission directions. The UPK-1 also allows programming of transmission of number dialing pulses at 9, 10 or 11 pulses per second. The device is made of semiconductor elements and integrated circuits mounted on printed circuit boards. It is powered by the standard 60 V power supply used for long-distance telephone exchanges. The UPK-1 device has passed operation testing and is ready for series production. Figures 3; tables 1.

HUNGARY

FIRST EXPERIENCES WITH THE LD 8000/24-IC MICROWAVE RADIOTELEPHONE SYSTEM.
PART 1

Budapest BHG ORION TERTA MUSZAKI KOZLEMENYEK in Hungarian Vol 23, No 1,
1977 pp 10-16

ROSTAS, JOZSEF, electrical engineer, Department of System-Engineering
Development, Orion Radio and Electrical Works

[Abstract] Type LD 8000/24-IC microwave radiotelephone equipment is manufactured by the ORION Plant and was developed by TKI and the system operates in the 8 GHz band, and is designed to transmit 24 telephone channels; it is fully solid-state. This microwave radio-relay system may be used in industrial communication networks and short postal lines. The specified operation temperature is -55°C to $+45^{\circ}\text{C}$. The system, designed for stationary use, consists of two parts: (1) the unit comprising the microwave transmitter-receiver, power supply, electronic units of the service channel, units of the signaling system, and air conditioning (mounted on the antenna); and (2) the ground unit comprising the line power supply unit, the switching unit, the cable correctors, and (in the case of the end station) the housing for underground placement. The individual components are described. They are the following: microwave transmitter-receiver, intermediate frequency amplifier, demodulator, base-band amplifiers, service telephone units, signaling system, power supply unit, and temperature regulator. Technical data are presented on the following: general system data, transmitter, antenna, multichannel telephone transmission, base-band connection, transmission performance data, service channel data, and general efficiency. Various versions, such as terminal stations, branchings (remotely controlling or remotely controlled), repeat station and network designing possibilities are briefly discussed. Figures 9.

HUNGARY

THE PRESENT AND THE FUTURE OF THE TRANSMISSION TECHNOLOGY DEVELOPMENTS AT
THE TELEPHONE FACTORY

Budapest BHG ORION TERTA MUSZAKI KOZLEMENYEK in Hungarian Vol 23, No 1,
1977 pp 17-20

PAL, GASZTON, graduate electrical engineer, senior department head,
Development Department, TRT [Telephone Factory]

[Abstract] At the present time, the Telephone Factory produces 3,000 to 4,000 channel connection paths in the air, corresponding to approximately 1.4 to 1.5 million channel-kilometers per year. The parameters are determined on the basis of the 10,000 kilometer hypothetical Soviet connection; there are remotely

supplied, unattended amplifiers in the lines. Among the recently introduced systems are: the portable 12-channel transmission system; the 300, 960, and 2,700 channel PCM system built under an LM Ericsson license; and the CMK-300 channel model [modulator-demodulator]. Manufacturing is modern in terms of equipment and procedures. Siemens electromechanical channel filters are used. Audio-frequency telegraphy systems with a 50-200 Baud rate are also produced. Reliability is improved by using hybrid integrated circuits; seven of these were recently developed. A PCM-compatible transparent telegraph multiplexer is also a recent development. A wide variety of signal translators is built, and new ones are under development. Work is in progress toward the creation of a petroleum and natural gas pipeline communication system (BK-300/G and BK/G); it features a radio network with cable operation. An N+N system will be completed in the near future. The farther future involves the increased use of digital transmission techniques and optical transmission.

HUNGARY

THE ARF 10 SYSTEM SATELLITE EXCHANGE

Budapest BHG ORION TERTA MUSZAKI KOZLEMENYEK in Hungarian Vol 23, No 1, 1977 pp 21-26

EISLER, PETER, graduate electrical engineer, Head of the Large System Development Department, Belioannis Communications-Engineering Factory

[Abstract] The ARF 10 system satellite telephone exchanges are built from ARF 102 type local exchange units; their call-number field is subordinated to that of the supraordinated exchange. The primary exchange is a Type ARF 102 exchange supplemented with circuits cooperating with the ARF 10 satellite exchange, and vice versa. The signaling system comprises the between-register communications (MFC system), the code-receiving circuit of the satellite exchange, and the line signal system (with a number of cooperating circuits). A satellite exchange system was established for economic and operational reasons in Districts XI and XXII of Budapest. In these districts, the population increased and the exchange could no longer supply the needs. The local primary exchange was supplemented with satellite exchanges which perform the local communications but are connected to the main system through the primary exchange only. The satellite exchanges are not independent systems; they depend on the highest-capacity exchange in the area. Unified design makes the satellite exchanges easy to maintain. Figures 10; table 1.

HUNGARY

RELIABILITY STUDY OF ELECTROMECHANICAL TELEPHONE SWITCHING UNITS

Budapest BHG ORION TERTA MUSZAKI KOZLEMENYEK in Hungarian Vol 23, No 1, 1977 pp 34-36

ROZGONYI, AKOS, graduate electrical engineer, group leader, Beloiannis Communications-Engineering Factory

[Abstract] Considerations involved in designing a reliability evaluation system are described, and some experiences gained with the operation of such a system are discussed. The system is suitable for evaluating the reliability (defined as the number of switchings before erroneous connections are made beyond a maximum permissible limit) of units being manufactured and also for forecasting the reliability of newly designed products. The main principle is to record the data in such a manner that they can later be processed as a function of the number of switchings or time. The reliability index is the maximum operability period in a reliable manner. Features must be provided to ensure that the analysis of the recorded data may be used for localizing defects and malfunctions. Trials with a testing system developed on this basis indicated that not only the static but also the dynamic aspects of contact-resistance increase must be taken into consideration. Reliability and lifetime are not necessarily parallel; the relationships between the two must be established by means of additional studies. Figures 2; references 3: 1 German; 1 Hungarian; and 1 Western.

USSR

TYPE ZhR-U RAILROAD RADIO STATIONS

Moscow AVTOMATIKA TELEMEXHANIKA I SVYAZ' in Russian No 9, 1977 pp 38-40

Unsigned

[Abstract] The ZhR-U set of standardized railroad radio stations has been supplemented with new models. These include the station set 43RTS-A3-ChM (ZhR-UK-SP) and the locomotive set 42RTM-A2-ChM (ZhR-UK-LP). The 71RTS-A2-ChM should be used in place of the 38RTS-A2-ChM (ZhR-U-SS) and the 72RTM-A2-ChM should replace the 39RTM-A2-ChM (ZhR-U-LS) for communication between stations. All of the new radio sets are completely transistorized. The characteristics of the radio sets are listed. Tables, 3.

USSR

UDC 517.94

SCALAR INTEGRAL EQUATION FOR ELECTRODYNAMIC CALCULATION OF HETEROGENEITIES
IN STRIP LINES

Novocherkassk IZV.VUZ:ELEKTROMEKHANIKA in Russian No 7, Jul 77 pp 739-749

MUSHENKO, SERGEY VASIL'YEVICH, candidate in technical sciences, Dotsent,
Tagangorsk Radio Engineering Institute

[Abstract] A study is made of the theory of heterogeneities in strip lines, on the assumption that the theory of regular strip lines has been constructed. A partially filled "rectangular" wave guide with ideally conducting walls is analyzed. The horizontal cross section of the wave guide is divided by two (for simplicity) layers of a magnetodielectric. The absolute magnetic and dielectric permeabilities of the medium are assigned in the two areas of its cross section. An ideally conducting film of 0 thickness limited by a closed contour is located parallel to the horizontal walls. The limiting contour is divided into two parts. Expressions presented unambiguously define the field in terms of the values of its divergence and rotor. Then, the vector electrodynamic problem of finding the current can be reduced to sequential solution of several scalar problems. The method suggested can be easily extended to the case when there are more (or less) than two regular semi-infinite lines, which need not be galvanically coupled to the branching surface. An example is appended. Figures 1; references: 9 Russian.

USSR

UDC 621.372.8.049.75

ANALYSIS OF FERRITE STRIP LINES WITH LONGITUDINAL MAGNETIZATION BY THE METHOD
OF SINGULAR INTEGRAL EQUATIONS

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 22, No 9, Sep 77 pp 1803-1810 manuscript received 24 Nov 75

IVASHKA, V. P., LAUCHYUS, YU. A. and SHUGUROV, V. K.

[Abstract] A universal and simple method is shown of calculating the parameters of strip lines on ferrite substrates with longitudinal magnetization, which treats the vector potential in the TEM-approximation. The relative magnetic permeability of the gyromagnetic substrate is represented by a tensor and the vector potential of a wave is expressed in integral form. Singular integral equations are obtained from an appropriate representation of harmonic functions with a derivative in the boundary condition. A computer-aided numerical solution of such equations, reduced to a system of algebraic equations by the Krylov-Bogolyubov method, is shown on the examples of a simple strip line and a coupled microstrip line on grade IOSCh6 ferrite. A field map based on these numerical results indicates the distribution of polarization ellipses of magnetic induction in the second case. Figures 6; references 10: 6 Russian; 4 Western.

USSR

UDC 621.316.825

DYNAMIC PROPERTIES OF SEMICONDUCTOR HEAT-CONTROLLED RESISTORS

Novocherkassk IZV.VUZ:ELEKTROMEKHANIKA in Russian No 7, Jul 77 pp 832-834
manuscript received 5 Jun 73; after completion, 24 Mar 75

POPIVNENKO, VIKTOR VASIL'YEVICH, candidate in technical science, Dotsent Rostov [No Dono] Institute of Railroad Transport Engineers; and BOLOTOVA, LARISA ALEKSANDROVNA, instructor [rukovoditel'] of group of "Yuzhgiprovodkhoz" [possibly "Southern Institute for the Planning of Water Management and Reclamation Construction"], (Rostov na Dono)

[Abstract] In order to determine the form of the transfer function of indirectly heated thermistors, a study is made of the transient process in the devices with internal heating when there is a sudden change of current in the heater. In order to simplify analysis, the temperature gradient in the body of the thermistor is ignored. It is assumed that no heat is supplied to the thermistor from the environment. The use of typical temperature characteristics of thermistors in this situation, as well as the dynamic properties of the electric circuits in which they are contained, makes it unnecessary to measure the volt-ampere characteristics of thermistors, to perform intermediate graph analysis, and significantly simplifies and increases the accuracy of calculations. Calculations can be performed analytically, allowing modern computer devices to be used. References: 6 Russian.

USSR

UDC 621.372.2:621.396.677.71

QUASI-STATIC THEORY OF THE FUNDAMENTAL WAVE IN A SLOT LINE

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 22, No 9, Sep 77 pp 1820-1828 manuscript received 16 Nov 76

VAYNSHTEYN, L. A., LESIK, N. I. and KONDRAT'YEV, B. V.

[Abstract] A slot line consists of two wide parallel conductor tapes separated by a slot on one side of a magneto-dielectric plate. The electrodynamic theory of waves in such a system involves unwieldy calculations and requires the aid of a computer. The theory of the fundamental wave under quasi-static conditions, on the other hand, yields a comparatively simple relation similar to that for a surface wave along a strip line. This relation is derived here from the fundamental integro-differential equations for a slot line. The general solution is applied to a slot line with radiative attenuation and then to a proper slot line without radiative attenuation. Some numerical results are shown here which have been obtained by the variational method and with the proper choice of the trial function for the capacitance. Figures 5; references 6: 3 Russian; 3 Western.

USSR

UDC 621.372.061

LIMITATION OF THE SET OF POSITIONS OF FIXATION OF PATHS IN THE SOLUTION OF THE PROBLEM OF PATH SELECTION IN THE DESIGN OF PRINTED MICROCIRCUITS

Moscow IZV.VUZ:RADIOELEKTRONIKA in Russian Vol 20, No 8, Aug 77 pp 91-95
manuscript received 27 May 76; after revision, 26 Jul 76

SOSNITSKIY, A. V. and SHAMAN, P. A.

[Abstract] A study is made of an approach to path selection in regular structures consisting of periodically placed microcircuits on printed circuit boards, and the minimum set of positions for placement of connections is determined which can fulfill the requirement of mutual nonintersection of paths and still not exceed the throughput capacities of the sections of the layers of the printed circuit boards. A model of the topology of the installation space of the multiple-layer printed circuits and a path connection algorithm are presented, calling for transitions of paths from layer to layer and the connection of fragments of circuits only at the points of placement of the contacts of microcircuits and plugs. The model of the multilayer printed circuit analyzed considers the minimum possible number of points of attachment of printed conductors. The algorithm generated can minimize path connection time and improve path connection quality by effective utilization of the throughput capacity of areas of the printed circuit. Figures 1; references 2: 1 Russian; 1 Western.

USSR

UDC 621.372.414

OPEN COAXIAL RESONANCE STRUCTURES (REVIEW)

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 22, No 9, Sep 77 pp 1769-1802 manuscript received 21 Dec 76

NEFEDOV, YE. I.

[Abstract] The excellent features of open resonators include their widely spaced spectra and high Q-factors as well as simple means by which energy can be transferred to and from them. Such resonators have found many applications in antenna-waveguide and measurement techniques, quantum and diffraction electronics, and other areas of operation at millimeter and submillimeter wavelengths. This survey covers only open resonators with a coaxial cylindrical structure, which are used in radiophysics for plasma jet and electron flux probing as well as for measuring the dielectric characteristics of substances. Conventional ones are designed with a rectilinear generatrix. The waveguide modes in a coaxial cylindrical line have been analyzed on the basis of the characteristic equations and their approximate solution by numerical methods has been made with the aid of a computer. In the case of a waveguide with an inner conductor having an impedance, the system of Maxwell equations

splits into two independent systems whose solutions describe an E-mode and an H-mode respectively, with a dispersion equation available for each. Open coaxial cylindrical resonators with curvilinear generatrices have also been developed recently, especially for use in wavemeters, diffraction-radiation generators, and magnetron-cyclotron-resonance generators. They either have a barrel-shaped external focusing reflector and a cylindrical internal reflector, or an external cylindrical reflector and a hyperboloidal internal focusing reflector. Tunable open coaxial cylindrical resonators with conical reflectors or biconical horn reflectors are a further development. The author thanks B. Z. Katsenelenbaum for comments expressed during reading of the manuscript. Figures 27; references 86: 71 Russian, 15 Western.

USSR

UDC 621.372.543

TUNABLE MATCHED FILTERS AND SIGNAL SHAPERS BASED ON ORTHOGONAL FILTERS

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 22, No 9, Sep 77 pp 1907-1915 manuscript received 10 Dec 75; after revision, 8 Feb 77

ANTONOV, O. YE. and IVANYUK, I. N.

[Abstract] A transmitter-receiver system is constructed here with the use of orthogonal filters for both signal shaping and synthesis of matched filters. A signal is shaped by delta-pulse excitation of orthogonal filters, with subsequent multiplication of the output voltage of each by an appropriate constant quantity and addition of the results. The signal thus shaped is then time limited by disconnection of the device from the rest of the transmitter channel at time $t > T_s$ (T_s denotes the desired signal width). Matched filters are synthesized by computer simulation. The method is illustrated on a few tunable matched filters using high-frequency orthogonal filters, but it applies also to low-frequency orthogonal filters. Figures 6; references 7: 5 Russian; 2 Western.

USSR

UDC 621.372.853

APPLICATION OF RESONATORS AND FILTERS ON A BASIS OF FERRITE SINGLE CRYSTALS (REVIEW)

Kiev IZV.VUZ:RADIOELEKTRONIKA in Russian Vol 20, No 7, Jul 77 pp 3-13 manuscript received 7 Jul 75; after revision, 23 Dec 76

IL'CHENKO, M. YE.

[Abstract] A survey is presented of microwave devices using single-ferrite resonators and filters on a basis of ferrite single crystals, their basic

principles and features, general characteristics, and recent major breakthroughs. Such devices include frequency filters, mode converters, antenna radiators, nonlinear and parametric devices such as limiters and power amplifiers, frequency multipliers, and conversion transducers. Also of interest are miniature multifunctional microwave devices combining these ferrite elements with various semiconductor elements, namely transistors and diodes, into tunable oscillators and amplifiers, harmonic generators, mixers, modulators, variable-band filters, and heterodyne components as well as superheterodyne components. Figures 11; tables 2; references 36: 20 Russian; 16 Western.

USSR

UDC 621.372.8

HARMONICS OF THE CONVECTIVE MICROWAVE CURRENT IN THE PROBLEM OF SYNTHESIZING SLOW-MODE WAVEGUIDES

Kiev IZV.VUZ:RADIOELEKTRONIKA in Russian Vol 20, No 7, Jul 77 pp 101-105
manuscript received 5 Apr 76

NERPINA, N. N.

[Abstract] The interaction is analyzed which occurs between a bunch of moving charges and a traveling wave in a slow-mode waveguide. The flux of discrete charges is regarded as a convection current containing higher harmonics, and the problem is the harmonic content of the load current. This harmonic content is determined by the shape and the dimensions of the bunch as well as by the charge distribution within it. A correct calculation of these parameters requires a self-consistent solution of the field equations and of the equations of motion for the charges. The problem is solved in the one-dimensional approximation, with the wave field and the convection current averaged over the cross section of the charge flux. A model of physical phenomena is used which describes the dynamics of charge redistribution within a bunch upon its entering the field of a traveling electromagnetic wave. The results indicate that this redistribution, during its first and second stage, does not noticeably affect the harmonic content of the convection current. However, this redistribution changes the coefficient of the fundamental component and produces an additional phase shift of a magnitude which can be as large as 16 percent. Figures 6; references: 4 Russian.

USSR

UDC 621.372:852.6

COMPUTER-AIDED DESIGN AND OPTIMIZATION OF WAVEGUIDE STEPPING TRANSFORMERS

Moscow RADIOTEKHNIKA in Russian Vol 32, No 10, Oct 77 pp 37-42 manuscript received 14 Apr 77

PEKELIS, M. A. and UVBARKH, V. I.

[Abstract] Waveguide stepping transformers can be designed by classical methods only when the drop of characteristic impedance between waveguide segments to be matched is either independent of or only weakly dependent on the frequency. When a plain waveguide segment is to be matched with one whose critical frequency is near its lower cutoff, then the frequency dependence of the impedance drop becomes very strong. For this case an approximate method is shown here as the basis of design and subsequent optimization of nonhomogeneous waveguide stepping transformers. Its gist is illustrated on a one-step and a two-step transformer. It also provides a good starting point for optimization of multistep transformers with maximum bandwidth and minimum sensitivity to dispersion of parameters. Figures 4; references 8: 5 Russian; 3 Western.

USSR

UDC 621.374.5.55

A PROMISING TREND IN THE DEVELOPMENT OF ELECTROMECHANICAL DELAY LINES

Moscow RADIOTEKHNIKA in Russian Vol 32, No 9, Sep 77 pp 95-97 manuscript received 28 Feb 77

KHANOVICH, I. G., GRIGOR'YEV, I. N., DRUKKER, V. Z., and KAPRANOV, R. I.

[Abstract] Theoretical and experimental studies have shown that thermally stable wide-band electromechanical delay lines with a metallic tape as sound conductor are most promising in terms of performance and ease of manufacturing. Their advantages are a wide passband (up to 98 percent of the natural frequency of the piezoelectric transducer at the -3 dB point) and a high thermal stability (with a temperature coefficient of delay not exceeding $1.5 \cdot 10^{-6}/^{\circ}\text{C}$). Their technology is simple and can be standardized, because the basic process stages do not depend on the magnitude of the delay. Typical technical data of such delay lines compare favorably with those of similar delay lines with a vitreous sound conductor. Figures 3; tables 1; references: 7 Russian.

HUNGARY

UDC 621.314.2.049.776:621.314.027:621.314.029

CONSTRUCTION AND HYBRID-CIRCUIT REALIZATION OF VOLTAGE-FREQUENCY CONVERTERS

Budapest HIRADASTECHNIKA in Hungarian Vol 28, No 7, Jul 77 pp 204-209
manuscript received 22 Feb 77

KUN, LASZLO, Research Institute for the Communications-Technological
Industry

[Abstract] Voltage-to-frequency converters represent a versatile member of the family of analog-to-digital converters. Under support of the OMFB [National Technical Development Committee], studies are underway on the applications of the former. This article describes the operation of voltage-to-frequency converters, and describes some specific applications. These converters can be used to best advantage where the conversion time is a free parameter. Under the appropriate conditions, the output information is the period time of the signal, which is inversely related to the input voltage. The converters are relatively inexpensive, highly accurate, and provide easily processable analog-to-digital conversion. The following applications are described briefly: data transmission of slowly changing signals with a voltage-to-frequency converter, temperature telemeter, digital voltmeter with voltage-to-frequency converter, step-motor drive, and speed control system. The importance of analog-to-digital converters in general, and of voltage-to-frequency converters in particular will increase with the increased use of computerized process control. Figures 13; tables 1.

USSR

UDC 538.3

EXPERIMENTAL STUDY OF ELECTROMAGNETIC FIELD WITHIN THE SHIELDING OF CRYOGENIC ELECTRICAL MACHINES

Novocherkassk IZV.VUZ:ELEKTROMEKHANIKA in Russian No 8, Aug 77 pp 901-904
manuscript received 18 Sep 74; after completion, 6 Feb 75

SCHASTLIVYY, GENNADIY GRIGOR'YEVICH, candidate in technical sciences, Director Institute of Electrodynamics, Academy of Sciences Ukr SSR; TITKO, ALEKSEY IVANOVICH, candidate in technical sciences, Scientific worker, Institute of Electrodynamics, Academy of Sciences, Ukr SSR; and PYZHOV, ALEKSANDR ARKAD'YEVICH, graduate student, Institute of Electrodynamics, Academy of Sciences, Ukr SSR

[Abstract] Reliable and economical turbogenerators with a superconducting excitation coil are feasible, if the superconductors have been stabilized in a widely varying electromagnetic field with minimum power loss. Effective shielding of these superconductors during abnormal and transient operating conditions is thus an important design factor. For the purpose of design estimates, the magnetic induction within such shielding systems was measured in a laboratory experiment with two models of two-layer stator windings: a 2-pole winding with a mean radius of 0.125 m operating under an electric load of 6360 A/m and a 4-pole winding with a mean radius of 0.11 m operating under an electric load of 6150 A/m. The test data, shown in the form of field maps and compared with theoretical relations, indicate that the distribution of magnetic induction is largely affected by the coil heads. This method is found adequate for engineering purposes. Figures 3; references: 4 Russian.

USSR

UDC [621.335:625.2.012.858:538.65]:621.313.13-12

SUPERCONDUCTING SOLENOIDS FOR SUSPENSION OF HIGH-SPEED OVERHEAD TRANSPORTATION FACILITIES

Novocherkassk IZV.VUZ:ELEKTROMEKHANIKA in Russian No 8, Aug 77 pp 875-878
manuscript received 31 May 76

OMEL'YANENKO, VIKTOR IVANOVICH, candidate in technical sciences, Dotsent, Kh'arkov Polytechnical Institute; BOCHAROV, VASILIIY IVANOVICH, candidate in technical sciences, Assistant to Director of VE& NII [possibly "All-Union Electrotechnical Scientific-Research Institute"] in Scientific Work; DOLGOSHEYEV, EDUARD ANGONOVICH, assistant head, Division of Magnetic Suspension, VE& NII; and USICHENKO, YURIY GRIGOR'YEVICH, Senior engineer, Kh'arkov Polytechnic Institute

[Abstract] A superconducting solenoid is the most important component of a suspension for overhead transportation facilities operating on the

repulsion principle. Its design is aimed at producing an adequate magnetic field within the active zone, to ensure a high ratio of lifting force to braking force, the necessary speed dependence of both forces, and a high ratio of lifting force to solenoid mass. The design must also be both technologically and economically feasible. For safety considerations, the magnetic field intensity inside the passenger compartment must be minimum. A survey of existing designs indicates a preference for "race track" solenoids of quasi-rectangular shape. While all designers already agree on a coil width within 0.25-0.6 m, the optimum coil length has not yet been established. Intrinsic stabilization of superconductors by stranding and twisting has pushed the maximum allowable current density to 200 A/mm^2 and the energy storing capacity of magnets to 100 kJ, a capacity of 1 MJ being within reach. The recommended coil dimensions for laboratory models are 1 m length and 0.3 m width, to carry magnetizing currents up to 0.3 MA. Figures 1; tables 1; references: 18 Western.

USSR

UDC 537.874.6

ASYMPTOTIC THEORY OF DIFFRACTION OF A PLANE ELECTROMAGNETIC WAVE AT AN IDEALLY CONDUCTING BODY OF REVOLUTION

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 22, No 9, Sep 77 pp 1811-1819 manuscript received 4 Jun 76

ORLOVA, N. S. and ORLOV, YU. I.

[Abstract] The asymptotic solution to the three-dimensional diffraction problem is considered in the case of a plane electromagnetic wave at a body of revolution which constitutes an ideal conductor with large electrical dimensions ($kR_{1,2} \gg 1$, where $R_{1,2}$ denote the principal radii of curvature). The radiation pattern and the caustic surface are calculated and plotted, according to an equation of geometric optics and the asymptotic method of solution, for a prolate spheroid resulting from the deformation of a sphere. Of particular interest is the field distribution within and near the shadow zone, on the basis of which the scattered field can be determined by asymptotic methods and application of the reciprocity theorem. Figures 6; references 12: 9 Russian; 3 Western.

USSR

UDC 550.388.2

VARIATIONS IN THE LEVEL OF RADIO NOISE IN THE SW BAND AS A FUNCTION OF DEGREE OF DISTURBANCE OF THE IONOSPHERE IN THE POLAR AURORA ZONE

Gor'kiy IZV.VUZ:RADIOFIZIKA in Russian Vol 20, No 8, 1977 pp 1238-1239 manuscript received 10 Mar 76

BLAGOVESHCHENSKIY, D. V. and DEGTYAREV, V. I., Siberian Institute of Terrestrial Magnetism, the Ionosphere and the Propagation of Radio Waves, Siberian Affiliate, Academy of Sciences, USSR

[Abstract] The data produced in an experimental study of radio noise in the zone of the polar auroras are interpreted. The method of measurement consisted in recording the levels of radio noise in the SW band at 10 fixed frequencies using a receiver with a transmission band width of 3 kHz. Directions of reception both parallel and perpendicular to the zone of the polar aurora was studied using two antennas. Each was a dipole suspended 20 m above the earth, with a total length of 16 m. Operations were conducted around the clock during a year of minimal solar activity, during both quiet and perturbed ionosphere periods in winter and at the equinox. Figures 1; references 4: 3 Russian; 1 Western.

USSR

UDC 621.371.25

DETERMINATION OF RANDOM CHANGES IN THE HEIGHT OF THE IONOSPHERE ON THE BASIS OF FLUCTUATIONS IN VLF SIGNAL PHASE

Gor'kiy IZV.VUZ:RADIOFIZIKA in Russian Vol 20, No 8, 1977 pp 1138-1145
manuscript received 15 Mar 76; after completion, 25 Jan 77

KRAVCHENKO, V. F., PONOMAREV, V. I. and FAL'KOVICH, I. S., Khar'kov
Aviation Institute

[Abstract] Fluctuations in height of the lower boundary of the ionosphere are determined by a method which uses as its initial data fluctuations in the phase of the electromagnetic field of received VLF-band radio signals. This band was selected because it was assumed that the wave guide consisting of the earth and the ionosphere has a single mode at this wave length, an assumption which is clearly incorrect for shorter wave lengths. One peculiarity of the problem of restoration of fluctuations in the height of the ionosphere by this method is that the experimental data produced at a single reception point are functions of time, whereas the function to be restored is a function of coordinates. This difficulty is overcome by assuming transverse movement of heterogeneities, so that a geographic coordinate can be replaced by time. The solution is presented in the form of an expansion of known functions determined from observed data. The authors thank P. V. Bliokh and V. G. Bezradnyy for their useful advice and discussion of the results. References: 5 Russian.

USSR

UDC 621.371

FLUCTUATIONS OF THE PHASE DIFFERENCE AND OF ITS DERIVATIVE DURING PROPAGATION OF RADIO WAVES THROUGH A TURBULENT ATMOSPHERE

Moscow RADIOTEKHNIKA in Russian Vol 32, No 9, Sep77 pp 32-36 manuscript received 4 Nov 75

MISHIN, A. M.

[Abstract] Experimental data were obtained by radiointerferometry of a source orbiting beyond the atmosphere. The statistical characteristics of the phase difference and of its derivative indicate that the isotropic model of a turbulent atmosphere is not adequate. A major factor affecting the fluctuations is the vertical component of an effective "wind" caused by azimuthal movement of the source. The phenomenological model of horizontal layers fits the experimental data much better and can serve as a proper basis for analyzing the random field of the atmosphere by radiophysical methods. Calculations based on this model agree closely with experimental data which the U.S. National Bureau of Standards obtained in Hawaii. The author thanks V. I. Tarskiy for a consultation with respect to theoretical problems. Figures 2; references: 5 Russian; 2 Western.

USSR

UDC 621.371.246

RESULTS OF MEASUREMENT OF ATMOSPHERIC ABSORPTION OF RADIO WAVES ON THE
SLOPE OF THE O_2 BAND AT $\lambda \sim 5.6$ mm

Gor'kiy IZV.VUZ:RADIOFIZIKA in Russian Vol 20, No 8, 1977 pp 1239-1241,
manuscript received 5 Jun 76

TROITSKIY, A. V., Scientific-Research Institute for Radio Physics

[Abstract] Experimental studies of atmospheric absorption were conducted in the 53-54 GHz band ($\lambda = 5.66$ and 5.56 mm) in June, 1975. [The results of the work were partially reported at the All-Union Symposium on Devices, Techniques and Propagation of Millimeter and Submillimeter Waves in the Atmosphere.] Vertical absorption of radio waves was determined on the basis of attenuation of solar radiation at various zenith angles using a tunable superheterodyne radiometer with a signal integration time constant of 1 s. The antenna used was a 130-cm diameter paraboloid with a reception pattern at half power level about 20' wide. Observations were conducted on clear days under stable weather conditions. The experimental data agree rather well with calculated data based on formulas presented in earlier works [including: E. E. Reber, J. Geophys. Res., 77, No 21, 3831 (1972)]. The authors thank A. P. Naumov for the discussion of results produced and M. B. Zinicheva and A. N. Minyakov for help in conducting the work. Figures 1; references 9: 6 Russian; 3 Western.

USSR

UDC 621.371.352

AMPLITUDE AND PHASE DISTRIBUTION FUNCTIONS IN A FIELD OF VERY LONG WAVE
SIGNALS AROUND THE INTERFERENCE MINIMUM

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 22, No 9, Sep 77
pp 1976-1978 manuscript received 14 Apr 76

BEZRODNYI, V. G. and YAMPOL'SKIY, YU. M.

[Abstract] Amplitude and phase distributions of SDV [very long wave] signals around the interference minimum in a waveguide are analyzed here, on the premise that the field at the observation point is determined by interference of two fundamental waveguide modes with large phase and small amplitude fluctuations. Measurements of SDB signals in the earth-ionosphere waveguide have confirmed the validity of this statistical model and have yielded a double-peak phase distribution curve, according to theoretical predictions. Figures 2; references 5: 4 Russian; 1 Western.

USSR

UDC 621.371.399

POLARIZATION OF THERMAL RADIO FREQUENCY EMISSION FROM NÈVÈ FIELDS BASED ON MEASUREMENTS FROM A "METEOR" SATELLITE

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 22, No 9, Sep 77 pp 1883-1889 manuscript received 11 Dec 75; after revision, 17 Mar 77

GURVICH, A. S. and KRASIL'NIKOVA, T. G.

[Abstract] Media such as Antarctic icebergs with volume density inhomogeneities in the form of a nève field can be probed from weather satellites. Such measurements are evaluated here in terms of thermal fluctuations and polarization of the thermal radio frequency emission in a diffraction field. The analysis is based on calculating the power loss and the luminance temperature in a single-scatter approximation. The accuracy of this method is estimated by comparison with experimental data. The authors thank I. P. Vetlov for attention to the work, and A. S. Gorelik and Ye. P. Dombkovska for helpful discussion. Figures 2; tables 2; references 16: 11 Russian; 5 Western.

USSR

UDC 621.371.399+550.372

SEASONAL VARIATIONS OF THE ELECTRICAL PROPERTIES OF THE GROUND-LAYER MEDIUM OVER THE 10-1000 kHz RANGE

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 22, No 9, Sep 77 pp 1890-1893 manuscript received 3 May 76

DORZHIYEV, V. S., ADVOKATOV, V. R. and TSYDYPOV, CH. TS.

[Abstract] Seasonal variations of the electrical properties in the ground-layer medium were studied experimentally by vertical electrical probing and by radioelectromagnetic profiling of sections across deposits of various granular contents (loam soil, forest, sand, and gravel), dry or moist. Measurements of the electrical resistivity and conductivity over the 10-1000 kHz range of frequencies were made in the Transbaykal region with a distinct continental climate. The results indicate a freezing to the depth of 1.5-6.0 m, with the resistivity increasing 2-10 times above that of thawed matter. The magnitude of the surface impedance and the effective conductivity within SDV [very long wave] range will, therefore, not vary much seasonally but will increase with increasing frequency. The seasonal variations of the effective electrical parameters have a much larger amplitude in inundated than in dry soils. Figures 4; tables 2; references: 7 Russian.

EFFECT OF THE GEOLOGICAL STRUCTURE OF A RIDGE CREST ON THE INTENSITY OF A
UHF DIFFRACTION FIELD WITHIN THE RIDGE SHADOW

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 22, No 9, Sep 77 pp 1963-
1965 manuscript received 14 Apr 76

TROITSKIY, V. N.

[Abstract] When the crest of a diffracting barrier such as a mountain ridge is sufficiently sharp, then its top part can become semitransparent to meter waves and will thus modify the field within the shadow zone. This problem is analyzed here by simulating such a ridge crest with a dielectric prism on a reflecting base and applying the Kirchhoff-Kotler method to geometric optics, for calculating the attenuation characteristics. Experimental data interpreted in terms of this analysis indicate that the geological structure as well as the electrical properties of a ridge crest have a significant effect on the diffraction of UHF waves. Figures 2; references: 3 Russian.

Instruments and Measuring Devices;
Methods of Measuring

USSR

UDC 531.761.089.68:621.3.018.12

DEVICES FOR DUPLICATING STANDARD REFERENCES OF TIME INTERVALS

Moscow IZMERITEL'NAYA TEKHNIKA in Russian No 7, Jul 77 pp 42-45

ZHILIN, N. S. and SUBBOTIN, L. S.

[Abstract] The error of existing phase-difference to time-interval converters lies within $\pm 0.1^\circ$. The accuracy of time measurement on the basis of higher input signal frequencies is greatly improved by frequency division at the output of such a converter. Triggers with limited response speed are not as effective as automatic-frequency-control devices of the phase type or the phase-pulse type, with discrete phase control. Both systems are astatic with respect to frequency and, therefore, coherent start-stop pulse sequences can be generated in a two-channel system. A circuit and performance analysis indicates that with such devices it is possible to duplicate time intervals ranging from fractions of a second to 100 ns. The systematic error can be reduced to the order of ± 5 ns and the random error does not exceed ± 25 ns over the entire range of time intervals. Figures 4; references: 3 Russian.

USSR

UDC 621.317.72.029.4

A LOW-FREQUENCY PHASE METER WITH A SINGLE-BAND FREQUENCY CONVERSION

Moscow IZMERITEL'NAYA TEKHNIKA in Russian No 9, Sep 77 pp 63-64

ZIMIN, N. P., SKRIPNIK YU. A. and YANENKO, A. F.

[Abstract] A low-frequency phase meter is described in which the problem of separating the test frequency from parasitic side-band combination frequencies has been solved and whose operating range has thus been extended below 500 Hz by the use of single-band converters as mixers in the first heterodyne stage. Such a converter consists of a controlled discrete phase shifter, a heterodyne oscillator, phase-controlled automatic frequency tuning, a frequency divider, and a single-frequency phase meter. A schematic diagram of the instrument is shown. The fundamental voltage and time relations which determine its performance are also given. Figures 1; references: 4 Russian.

USSR

UDC 621.317.77.089.6

USE OF INSTRUMENT TRANSDUCERS FOR CHECKING OUT PHASE METERS

Moscow IZMERITEL'NAYA TEKHNIKA in Russian No 7, Jul 77 p 86

KHOMYAK, V. A. and SUKHENKO, T. V.

[Abstract] Two three-phase model F5076 instrument transducers, which convert active and reactive power to standard d.c. current signals for checking out three-phase wattmeters, can also be used for checking out single-phase and three-phase phase meters. This is demonstrated here in the single-phase case, with the voltage coils of the transducers in parallel with that of the phase meter, the current coils of the transducers in series with that of the phase meter, an adjustable resistor across the output of each transducer, and a balance indicator across both. The phase shift between voltage and current is calculated from balance readings according to a simple formula. The checkout error is a function of the phase shift as well as of the transducer errors and the resistor errors. Figures 1; references: 1 Russian.

USSR

UDC 621.317.089.68:621.317.382.023

A CHECKOUT SYSTEM AND REFERENCE INSTRUMENTS FOR POWER FLUX DENSITY MEASUREMENTS WITHIN THE 1-16 GHz FREQUENCY RANGE

Moscow IZMERITEL'NAYA TEKHNIKA in Russian No 9, Sep 77 pp 53-54

LEVIN, M. M. and LEYBOVICH, R. L.

[Abstract] A system has been developed for checking out model PO-1 and P3-9 instruments used for measuring the power flux density in waveguides and antennas with the aid of appropriate transducers. The basic reference system includes a set of horn antennas, a wattmeter, a frequency meter, a set of oscillators, a radiating auxiliary antenna, antenna mounts, and antenna drives. There is a primary system and a secondary system of horn antennas connected to five power flux transducers, two of the thermistor type with II-inputs and three of the thermocouple type, each covering another part of the 1-16 GHz frequency range. For checking out laboratory or industrial instruments, the secondary reference set must face an area at least as large as 45 m^2 in a compartment completely free of objects and personnel. The main advantage of this system is that no mounting adjustments are necessary and no changes in the temperature field occur from one set of measurements to another, so that null drift of the digital voltmeter or of the thermistor bridge and thus also random checkout errors are eliminated. Tables 1; references 4: 1 Russian; 3 Western.

USSR

UDC 621.317.335.3.029.6.08

AN IMPROVED METHOD OF MEASURING THE DIELECTRIC PERMITTIVITY OF SUBSTRATES
FOR INTEGRATED-CIRCUIT MICROWAVE DEVICES

Moscow IZMERITEL'NAYA TEKNIKA in Russian No 7, Jul 77 pp 87-89

ZAL'TSMAN, YE. B. and KOUDEL'NYY, A. V.

[Abstract] A nondestructive method of measuring the dielectric permittivity of substrates has been developed, especially for use in integrated-circuit microwave techniques with 0.5-3 mm thick rectangular plates, rather than with 5-7 mm high cylindrical specimens. The gist of this method is placing the substrate specimen inside a transverse slot in a coaxial resonator, in an H_{111} mode resonator, or in an H_{01n} -mode resonator and then calculating the dielectric permittivity according to a formula based on the system geometry. Necessary corrections are introduced to account for shape irregularities of both the specimen and the resonator, which include bending of the specimen and its effect on the total configuration. Calibration measurements have been made before and after insertion of a specimen into the resonator slot. The error of thickness measurement according to the 10-point rule did not exceed $\pm 1 \mu\text{m}$. The error caused by the presence of the slot did not exceed 0.03 percent for a substrate specimen 1 mm thick. The error caused by an inevitable clearance between the specimen and the resonator wall could be as large as 7 percent, but was reducible to within 0.1 percent. The random error, three times the standard deviation, was within 0.1 percent. The total error thus did not exceed 0.2 percent. Figures 4; references 7: 5 Russian; 2 Western.

USSR

UDC 621.317.361.089.68

SPECIAL GOVERNMENT REFERENCE STANDARD OF A UNIT FREQUENCY DEVIATION

Moscow IZMERITEL'NAYA TEKNIKA in Russian No 9, Sep 77 pp 3-5

SHPAN'ON, P. A., PAVLENKO, YU. F., RAYKHMAN, A. F., KOLBASIN, A. I. and KASHCHENKO, O. B.

[Abstract] For measurements in FM systems, a special Government reference standard of unit frequency deviation has been developed. It consists of a FM signal generator with harmonic modulation and a set of standard instruments, and a comparator transmitting the unit frequency deviation from this special reference standard to primary calibration instruments. These instruments operate in conjunction with an electronic frequency counter and by the classical method of Bessel function zeros. A schematic diagram is shown and both removable and unremovable systematic errors are analyzed. The characteristics of this special reference standard are compared with those of such standards used in other countries. Figures 1; tables 2; references 5: 4 Russian; 1 Western.

USSR

UDC 621.317.444:621.317.421

A HYPERFINE-STRUCTURE MAGNETOMETER FOR ABSOLUTE MEASUREMENTS OF THE MAGNETIC INDUCTION IN WEAK MAGNETIC FIELDS

Moscow IZMERITEL'NAYA TEKHNIKA in Russian No 7, Jul 77 pp 73-75

ALEKSANDROV, YE. B., MAMYRIN, A. B. and NAUMOV, A. P.

[Abstract] A magnetometer has been developed on the basis of exciting magnetic resonance at a microwave frequency between the components of the hyperfine structure of alkali metals in the ground state. An experimental evaluation of a prototype built on potassium vapor has established its suitability for accurate measurements of magnetic induction within the 10^{-7} - 10^{-3} T range. The random error lies within 10^{-2} nT. The use of any isolated transition within the microwave range eliminates all difficulties associated with multi-component resonance lines within the low-frequency range. Moreover, two symmetric resonances can be excited simultaneously with a frequency separation independent of the light intensity, which is equivalent to having a balanced system of two conventional magnetometers in one. Figures 2; references 18: 8 Russian; 10 Western.

USSR

UDC 621.317.757

ESTIMATING THE INSTRUMENT ERRORS OF DISCRETE-ANALOG SPECTRUM ANALYZERS

Leningrad IZV.VUZ:PRIBOROSTROYENIYE in Russian Vol 20, No 7, Jul 77 pp 18-21
manuscript received 31 Dec 76

SHUBS, YU. V. Paper recommended by Chair of Radio Reception and Radio Engineering Data Processing, Kiev Polytechnic Institute

[Abstract] The effect of instrument errors of spectrum analyzers on the accuracy of discrete Fourier transformation is evaluated. The n -th complex component of the spectrum is considered, including a random sine error and a random cosine error, with the weighting coefficients simulated by resistors in the matrix processor. There are assumed to be no systematic and statistical errors. The signal-to-noise ratio is plotted versus the error of the weighting resistors so that the accuracy parameters can be easily determined and the resistors selected for precision level to match a given set of data. Figures 1; references 3: 1 Russian; 2 Western.

USSR

UDC 621.318.2.001.4

DESIGN PRINCIPLES OF AN APPARATUS WITH AN OPEN MAGNETIC CIRCUIT FOR
PERMANENT-MAGNETIC TESTING

Moscow IZMERITEL'NAYA TEKHNIKA in Russian No 9, Sep 77 pp 67-68

ANDRIYEVSKIY, YE. A., LESNIK, L. N., NEPOKRYTYI, YA. F. and SHEVERDIN, G. P.

[Abstract] A digital permanent-magnet testing apparatus is described which features an open magnetic circuit for accommodating the magnet samples. It can be used for measuring the coercive force, the remanence, and $(BH)_{\max}$. Special components are included for automation of the measurement and control of the direct magnetizing field in the first quadrant of the hysteresis curve, inasmuch as a test sample will, after removal of that field, demagnetize to a point in the second quadrant. Provisions are also included for calibrating the apparatus either by a reference magnetic field across the gap of its open magnetic circuit or by standard reference magnets. Its main components are two Hall probes, a corrective amplifier, an adding circuit, a multiplying circuit, a controlled power source with a discharge capacitor bank, feeding the magnetizing coils through a transistor, a Schmidt trigger, a stabilizer, and a mode switching system. Figures 3; references: 4 Russian.

USSR

UDC 681.2/.3:621.372.632

A HYPERBOLIC TRANSDUCER FOR MEASURING SYSTEMS

Moscow IZMERITEL'NAYA TEKHNIKA in Russian No 9, Sep 77 pp 22-24

TOLOKNOVSKIY, V. R. and SHTEYNBERG, V. E.

[Abstract] A hyperbolic transducer is described which uses the pulse repetition rate or the pulse period as an information carrier. Piecewise-linear approximation of the conversion curve can be achieved with a theoretically necessary capacity equal to the number of parameters in the conversion function but independent of the number of approximation segments. Consequently, the conversion error ceases to vary from segment to segment and can easily be reduced to below 0.1 percent with a large number of segments. The principle is illustrated on a hyperbolic conversion curve with three parameters, an analysis of its simulation, and a schematic diagram of the instrument circuit. Figures 3; tables 1; references: 3 Russian.

HUNGARY

UDC 621.373.51

OSCILLATORS USING GUNN AND IMPATT DIODES

Budapest HIRADASTECHNIKA in Hungarian Vol 28, No 9, Sep 77 pp 273-279
manuscript received 17 May 77

BERCELI, TIBOR, dr; JUHASZ, KALMAN; NAGY, WALTER and SELLEI, TIBOR, Research
Institute for Telecommunications

[Abstract] The authors describe oscillators using Gunn and IMPATT diodes developed at the Research Institute for Telecommunications and present some results of studies carried out with them. The oscillators are available for the 6, 8, 10, and 12 GHz frequency bands. They generally operate at a fixed frequency, and have low FM noise. The cavity resonator is in a rectangular cross sectional waveguide. The oscillators are usually operated at close to the maximum output. The load impedance in the plane of the diode required for this is accomplished by means of the proper distance between the iris susceptance and the diode. The models developed are low-noise oscillators, modulated oscillators, controlled oscillators, and a three-stage controlled oscillator chain. The measurements performed involve the FM noise level, modulation characteristics, frequency stability, and tunability. For the chain, the resultant characteristics and the effects of the individual chains on them were examined. Tests were also carried out on the transmission characteristics of the controlled oscillators. Figures 23; references 12: 1 Yugoslav; 1 Hungarian; 1 Russian; and 9 Western.

USSR

UDC 621.375.5

IMPATT WAVEGUIDE-OSCILLATOR WITH AN EXTERNAL REFLECTING RESONATOR

Kiev IZV.VUZ:RADIOELEKTRONIKA in Russian Vol 20, No 7, Jul 77 pp 14-19
manuscript received 23 Feb 76

KOTSERZHINSKIY, B. A., MACHUSSKIY, YE. A. and TKACHENKO, L. A.

[Abstract] Oscillators on avalanche-transit-time diodes with an external reflecting resonator are used in many microwave systems. The performance of such an oscillator is analyzed here on the basis of the equivalent circuit diagram for a waveguide with the oscillator. Because the circuit parameters are frequency dependent, the calculations become unwieldy and require the aid of a digital computer for a numerical evaluation of the oscillation frequency as well as the necessary stabilization power, the frequency stabilization factor, and the loaded Q-factor of the stabilizing resonator. The performance is also evaluated experimentally and the results are found to agree closely with theory. Figures 6; tables 1; references 7: 3 Russian; 4 Western.

USSR

UDC 621.373.52

PULSE GENERATOR WITH BRIDGE TIME-SETTING CIRCUITS

Moscow IZV.VUZ:RADIOELEKTRONIKA in Russian Vol 20, No 8, Aug 77 pp 117-120
manuscript received 23 Dec 74; after revision, 18 Aug 76

DIMITRAKI, P. N.

[Abstract] The combination in a single device of the high speed of current switches with the stabilizing properties of an electric bridge, and the advantages of the method of inversion of both capacitors of the time-setting bridge in the synthesis of multiple-loop feedback, allow the creation of a new pulse generator circuit which has no equal in current practice with respect to a number of parameters: high pulse leading edge steepness and low sensitivity of pulse repetition frequency to variations in power supply voltage and ambient temperature. The basic elements of the circuit of the generator are current switches, resistors, the power supply and a time-setting bridge consisting of two resistors and two capacitors. The operation of the circuit is explained. An increase in the length of pulses in the infralow frequency range can be achieved by making the differential stage with field effect transistors, and the output switches with bipolar devices. Figures 3; references: 4 Russian.

USSR

UDC 621.383.8

CALCULATION OF THE OUTPUT SIGNAL FROM A PHOTODETECTOR WITH A CHANNEL STRUCTURE
OPERATING IN THE CHARGE-STORAGE MODE

Kiev IZV.VUZ:RADIOELEKTRONIKA in Russian Vol 20, No 7, Jul 77 pp 48-52
manuscript received 24 May 76

KAZYULIN, V. I. and MOCHALKINA, O. R.

[Abstract] A photodetector is described which has a channel structure for reducing the noise signal during integration of the light flux, i.e., operation in the charge-storage mode. The useful output signal from such a device is calculated here in the one-dimensional approximation, assuming: 1) uniform doping of the p-channel region, 2) nonparticipation of free carriers in generating a current through the depletion zones in the barrier layer, and 3) plane equipotential surfaces within the p-channel. An analysis shows that the width of the depletion zones and thus the performances mode of this photodetector depend on the magnitude of the probing pulse, with either immediate or delayed cutoff or no cutoff possible. Calculations as well as experimental data which pertain to a transistor with five identical channels indicate the advantages of this photodetector over a bipolar phototransistor or an MOS photodiode with charge storage. However, the technology of a channel transistor is more difficult. Figures 3; references 5: 3 Russian; 2 Western.

USSR

UDC 621.375.826

EXPERIMENTAL PROOF OF THE NECESSITY OF USING THE FRESNEL APPROXIMATION FOR
TRANSFORMING A LASER BEAM

Leningrad IZV.VUZ:PRIBOROSTROYENIYE in Russian Vol 20, No 7, Jul 77 pp 101-104 manuscript received 13 Oct 76

YEVTEYEV, G. V. and CHERNIGOVSKIY, V. V. Paper recommended by Chair of Gas-Discharge Devices, Leningrad Electrotechnical Institute imeni V. I. Ul'yanov (Lenin)

[Abstract] For use as a radiation source in measurement and information systems as well as in production of integrated microcircuits, a laser beam must be transformed to one with a specific intensity profile and a specific complex-amplitude profile over the cross section. This is achieved by means of optical diaphragms, with particular difficulties when this beam is to pass through a photo template or a screen mesh. A description of the irised laser beam in the Fraunhofer approximation is not always valid and, therefore, the Fresnel approximation is often used instead. Because the latter approximation is mathematically quite cumbersome, its validity can be more easily established experimentally. The results of such an experiment, with an LG-36A laser emitting a beam of the principal TEM₀₀-mode and the latter diffracting around a parallel slit, are compared with calculations on the basis of the simpler Fraunhofer approximation. The measurements were made on an optical bench with an FD7-K photodiode rectifier-detector irised by means of a circular diaphragm and a microammeter. Examination of the diffraction pattern and its fringes revealed that the maximum intensity or energy density of the laser beam within the central peak fringe largely depends on the position of the laser relative to the transformation optics. The comparison has revealed that the Fraunhofer approximation, valid for the diffraction of a plane wave, yields large errors when applied to the transformation of a laser beam. Figures 3; references 4: 2 Russian; 2 Western.

USSR

UDC 778.38

SYSTEMS FOR RECORDING AND RESTORATION OF LONG-WAVE FOURIER HOLOGRAMS WITH
SPECTRUM COMPRESSION

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 22, No 9, Sep 77 pp 1973-1976 manuscript received 4 Feb 76

BAZARSKIY, O. V.

[Abstract] A recording system and a restoration system for long-wave Fourier holograms are proposed in which the aperture can be reduced, as a result of compression of the spatial spectrum, without adversely affecting the resolution and without distorting the restored image. Provisions are made for varying the spectrum scale. Calculations of the reduction factor shows that these systems are suitable for holographing thin objects. Figures 2; references 7: 4 Russian; 3 Western.

USSR

UDC 621.37

POSSIBILITY AND LIMITATIONS OF OPTICAL NONSCALE MODELING OF RADAR IMAGING

Gor'kiy IZV.VUZ:RADIOFIZIKA in Russian Vol 20, No 8, 1977 pp 1146-1152
manuscript received 1 Jul 76

VASIL'YEV, V. N., Moscow Institute of Physics and Technology

[Abstract] The possibility is demonstrated of optical modeling of radar imaging and the adequacy of the signals and images obtained on the model in the optical wave band to radar images is theoretically proven. The conditions of adequacy and limitations of the method of nonscale modeling are determined. It is concluded that nonscale modeling is permissible for objects with surface curvature which is homogeneous at all points, for example, with surfaces consisting either of planes or of cylinders and cones, or of spheres. This conclusion can be extended to optical nonscale measurement of the effective scattering surface of objects. Modeling of apertures of complex shape and wide band signals requires that the angular dimensions of apertures and relative tuning ranges of signal frequencies be N/M times less than those of the radar signals, where M is the scale of the modeling, $N = \lambda_r/\lambda_o$ where the subscripts r and o represent the radio and optical frequency bands. In studying the influence of the propagation medium on the quality of the images reproduced, the model must be in a scale of $1:N/M$, with the amplitude-phase parameters preserved. Figures 1; references: 2 Russian.

USSR

UDC 621.391

DETECTION OF A NOISY SIGNAL WITH AMBIENT INTERFERENCE DURING SPATIALLY DIVERSE RECEPTION

Moscow RADIOTEKHNIKA in Russian Vol 32, No 10, Oct 77 pp 89-91 manuscript received 23 Nov 76

SHELUKHIN, O. I.

[Abstract] In such applications as short-range radar it sometimes becomes necessary to detect, with spatially diverse channels, an object submerged in ambient reflections from local objects and from the ground surface. Assuming a two-dimensional probability of the noisy signal and of the correlational interference in the channels, the effect of the signal-interference correlation factor in both channels of a two-channel system on the detection characteristics of this system during optimal reception is analyzed here on the basis of the weak-signal theory. The logarithm of the likelihood ratio is assumed to have a normal density and the detection characteristics are expressed in terms of Edgeworth series. Figures 1; tables 2; references: 2 Russian.

USSR

UDC 621.391.2

INFLUENCE OF ANTENNA DIMENSIONS OF INTERFERENCE STABILITY OF RECEPTION OF A SPACE-TIME SIGNAL

Moscow IZV.VUZ:RADIOELEKTRONIKA in Russian Vol 20, No 8, Aug 77 pp 102-104
manuscript received 23 Feb 76; after revision, 10 Jan 77

KREMER, A. I. and TRIFONOV, A. P.

[Abstract] A study is made of the problem of reception of a signal reflected from a small target located at arbitrary range from the receiving antenna. The dependence of the signal/noise ratio at the output of the optimal receiver on the dimensions and structure of the antenna is calculated, considering the curvature of the leading edge of the wave of the signal received. The equations produced can be used to find the boundaries of applicability of representation of the signal in a Fresnel approximation and the far zone for sufficiently precise calculation of the signal/noise ratio at the output of an optimal receiver. Figure 1; references 5: Russian.

USSR

UDC 621.396.663

SYNTHESIS OF THE OPTIMAL STRUCTURE OF A RADIO DIRECTION FINDER PERFORMING SIMULTANEOUS DETECTION OF A SIGNAL AND MEASUREMENT OF THE ANGLE OF ARRIVAL OF THE WAVES

Moscow IZV.VUZ:RADIOELEKTRONIKA in Russian Vol 20, No 8, Aug 77 pp 65-72
manuscript received 17 May 76; after revision, 25 Oct 76

KURILENKO, G. M.

[Abstract] Formulas are produced which define the optimal structure of a radio direction finder which simultaneously acquires and measures the arrival angle of an incoming signal. Methods of the theory of statistical solutions are used to define the optimal structure of the device, which utilizes independent observations at discrete moments in time. The structure produced differs from structures of existing devices which acquire and measure angles separately. The device synthesized is significantly more complex than traditional devices. It is necessary therefore to perform a cost-benefit analysis in each case to see if the advantages gained are worth the increase in complexity of the hardware. Figures 1; references: 6 Russian.

USSR

UDC 621.396.964.34

MOST PROBABLE RESOLUTION OF AN AMBIGUITY OF MULTISCALE PHASE MEASUREMENTS

Kiev IZV.VUZ:RADIOELEKTRONIKA in Russian Vol 20, No 7, Jul 77 pp 64-72
manuscript received 15 Mar 76

DENISOV, V. P.

[Abstract] Multiscale measurements are necessary for evaluating a quantity such as the phase angle or phase difference in radar over a wide range of its possible variation. Optimization of the data processing with respect to accuracy and reliability requires, in this case, a resolution of ambiguities. This problem is analyzed, assuming a typical case of a quantity x measured with n unequally precise instruments and taking into account normally distributed random errors. An expression for the probability of correct resolution is derived and this probability found to be conditional.

References 5: Russian, 1 Western.

USSR

UDC 656.25:621.317.7:656.212.5

A RADAR SPEED MEASURING DEVICE FOR SORTING YARDS

Moscow AVTOMATIKA TELEMEXHANIKA I SVYAZ' in Russian No 9, 1977 pp 3-5

VAVANOV, YU. V., director TsNII MPS [Central Scientific Research Institute of the Railroad Ministry], candidate in technical sciences, VERIGO, A. M., DAGAYEVA, N. KH., senior scientific associates, PEREGONOV, S. A., candidate in technical sciences, and KERNOV, YU. P., senior engineer

[Abstract] At the present time, railroad sorting yards make extensive use of centimeter and millimeter wave band Doppler radar sets to measure the speeds of train sections moving through braking sectors of the yards as trains are made up. Current Doppler radar sets, however, are sensitive to moisture dripping from train sections and have time constants which are too long. This article describes a fully transistorized 3-centimeter Doppler radar set designed to operate 2,000 hours before requiring maintenance, with a time constant on the order of a few 10ths of a second, capable of measuring speeds of 3-30 km/hr at a maximum range up to 100 m with an error of not over 3 percent. The device, called the DIS, is installed 4 m outside the track. A block diagram of the system and schematic diagrams of key sections are presented, as well as a photograph of the entire device. It comes in an aluminum body measuring 480 x 320 x 190 mm of airtight construction; power supply is by standard 220 v line, power consumption not over 20 w. Tests have shown that it can operate at temperatures between -40 and +60 C and is unaffected by the vibrations presented in railroad sorting yards. Figures 5;

USSR

UDC 621.396.621.53

CONDITIONS OF ATTENUATION OF MIXING CHANNELS IN A SUPERHETERODYNE RADIO
RECEIVER BY A WIDE-BAND PRESELECTOR

Moscow RADIOTEKHNIKA in Russian Vol 32, No 9, Sep 77 pp 98-101 manuscript
received 4 Mar 75; after completion, 20 Jul 76

SARAYEV, S. M.

[Abstract] Fast tuning of radio receivers does not always permit the use of tunable preselectors. In order to attenuate the interference signals, at least those outside the operating frequency band, one uses a wideband filter whose passband is equal to the tuning range of the receiver. An analysis of the frequency distribution of the mixing channels in a receiver yields the conditions of their sensitivity attenuation because of such a wideband preselector. These conditions are derived here and they imply that a wide-band preselector will attenuate the receiver channels mixing the fundamental signals, or the fundamental signals and their second harmonics. A preselector which attenuates the receiver channels mixing also higher signal harmonics will limit the tuning range of the receiver too much. The tuning range can be widened appreciably by frequency conversion with upper heterodyne tuning. Figures 1; tables 2; references 6: 4 Russian; 2 Western.

USSR

UDC 621.382.2:537.312.8

FREQUENCY DEPENDENCE OF THE MAGNETIC SENSITIVITY AND OF THE DYNAMIC RESISTANCE
OF SILICON MAGNETODIODES

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 22, No 9, Sep 77 pp 1953-
1955 manuscript received 23 Mar 76

KARAKUSHAN, E. I. and FATTAKHDINOV, A. U.

[Abstract] Silicon magnetodiodes are used in circuits with active loads, the performance of such circuits being determined by the magnetic sensitivity and the dynamic resistance of these devices. Measurements were made with specimens having the p-n junction formed on p-type silicon with a resistivity of $20 \text{ k}\cdot\text{cm}$. With a small load resistance, the dynamic resistance (slope of the current-voltage characteristic) decreases monotonically with increasing current. At lower frequencies it increases with increasing frequency, especially steeply from 5 to 20 kHz, then remains almost constant and equal to the base resistance (at a given bias current) at higher frequencies. The magnetic sensitivity (ratio of current increment to induction increment) also increases with increasing current. In a magnetic field 0.2 T strong, it remains almost independent of the frequency up to somewhere between 2 and 5 kHz and then decreases very steeply with higher frequencies. The voltage drop across the load resistance because of a change in the magnetic induction also increases with increasing frequency, and as a function of the magnetic induction it peaks at approximately 0.25 T at all frequencies. Figures 6.

EAST GERMANY

FOIL TECHNOLOGY - AN ALTERNATIVE TO THIN- AND THICK-LAYER TECHNOLOGY IN
THE MANUFACTURE OF MULTI-CHIP HYBRID COMPONENTS

East Berlin FEINGERAETETECHNIK in German Vol 26, No 6, 1977 pp 253-255

HINUEBER, W., graduate engineer, Electronic Technology and Precision
Instrument Section, Dresden Technical University

[Abstract] Foil technology offers the following advantages over thin- and thick-layer technology for the manufacture of multi-chip hybrid components: economical production of small series, need of relatively little new equipment, ability to use much of the existing equipment and methods used in thin- and thick-layer technology, easily accomplished conductor intersections, no need for imported and special materials, no need for special worker training. Single and dual layer chips may be made. The process steps for making single-layer chips are: cleaning of the copper foil and the ceramic substrate, lamination of the foil to the ceramic substrate, cleaning of the laminate, structuring by means of photolithography, and final processing. For making dual layer chips, the additional process steps are lamination of the insulating layer and the second foil, and completing the intermediate adhesive layer. It is estimated that the cost ratios of thin-layer, thick-layer, and foil technologies are 1.5:1:0.4. All components which can be manufactured by means of the thick- and thin-layer technologies can also be manufactured by means of the foil technology. Figures 4; tables 3; references 16: 3 Western; 13 German.

HUNGARY

UDC 517.982.43:621.39

FOURIER TRANSFORMATION AND COMMUNICATIONS ENGINEERING

Budapest HIRADASTECHNIKA in Hungarian Vol 28, No 9, Sep 77 pp 261-270
manuscript received 24 Jan 77

KERPAN, ISTVAN, dr, Kando Kalman Technical College for the Electrical
Industry

[Abstract] The article discusses some problems in communications engineering leading to Fourier transformation (FT), discrete FT, and fast FT. It is a summarizing review stressing application possibilities, which may be followed by those who are familiar with the fundamentals of complex numbers and real functions. Some of the communications engineering problems leading to FT are: measurement of the frequency spectrum of signals with a power meter, investigation of signal transmission in the time region, joint distribution of two probability variables, correlation functions, and a conversion of convolution. FT is a method for solving convolution and also for determining the power spectrum of stationary stochastic signals. The computation technology of FT, the introduction and uses of discrete FT, and the fundamental features and details of fast FT are briefly discussed. The use of computers, especially for discrete and fast FT, offers substantial advantages. Figures 7; references 13: 12 Hungarian; 3 Western.

VIBRATIONS OF RIGIDLY COUPLED ELECTRODES IN RADIOELECTRONIC APPARATUS

Minsk IZVESTIYA AKADEMII NAUK BELORUSSKOY SSR, SERIYA FIZIKO-TEKHNICHESKIKH NAUK in Russian No 3, Mar 77 pp 99-102 manuscript received 23 Dec 76

FASTOVETS, YE. P. and TYAVLOVSKIY, M. D., Minsk Radio Engineering Institute

[Abstract] Components of electronic devices such as transistors and some microcircuits are mechanically equivalent to two rigidly coupled beams with very different moments of inertia driven into a common base. Such a structure is considered here, namely a compliant beam and a stiff beam joined at one end and driven into the common base at their other ends. For an analysis of the dynamics, under a kinematic excitation, a damping term $\gamma \frac{\partial^5 y}{\partial x^4 \partial t}$ is added to

fundamental differential equation of motion for elastic bodies. This equation is then solved for resonances and the steady-state component of vibrations. The result explains the fracture of the compliant beam at the natural frequency of the stiffer beam. When the stiffer beam has a high Q-factor, then the resonance characteristics of the beam pair on a common base are determined by the product of two functions describing the resonance characteristics of the respective beams. Figures 1; references: 3 Russian.

POTENTIAL OF TWO POINT CURRENT SOURCES ON AN INFINITE HETEROGENEOUS CONDUCTING PLANE WITH RADIAL DISTRIBUTION OF CONDUCTIVITY

Moscow ELEKTRICHESTVO in Russian No 9, Sep 77 pp 85-86

MEYER, A. A., Moscow

[Abstract] The distribution of the potential generated by two point sources on an infinite heterogeneous conducting plane is of interest for a number of problems of potential theory. The problem of several sources can be reduced to the problem of a single source, because the potential of any number of sources is equal to the sum of the potentials of the individual sources. This article analyzes the case of a radial heterogeneity. The second source which is required for fulfillment of the condition of electroneutrality required by the condition of a plane field, is located at the center of the heterogeneity. The results produced can be used to solve various problems of potential theory on a plane with a radial heterogeneity. These include such problems as the distortion of a field of a point source caused by the presence of a circular aperture, the distribution of a field in a plane ring with arbitrary placement of sources of current and many other similar problems.

USSR

UDC 621.317.013.001.24

CALCULATION OF MAGNETIC CONDUCTIVITIES AND ELECTROMAGNETIC FORCES OF
UNBALANCED MAGNETIC CIRCUITS

Moscow ELEKTRICHESTVO in Russian No 9, Sep 77 pp 82-84

BUL', B. K., dr in technical sciences, Moscow Power Engineering Institute

[Abstract] The magnetic field generated by magnetic circuits with different-sized air gaps is quite complex, and is calculated in this article by graphic and analytical methods. It is assumed that the magnetic circuit is unsaturated and that the magnetic field is plane-parallel in individual sectors of the air path. U- and W-magnetic circuits are analyzed. The method analyzed in the article can calculate the full three-dimensional heterogeneous field in air gaps, determine the boundaries of the scattering field and calculate the total electromagnetic force acting on the armature. Because all conductances are known, it is easy to find the total flux of the excitor coil. Figures 3; references: 5 Russian.

USSR

UDC 621.372.81

VARIATION OF PARAMETERS IN THE PROBLEM OF A SPHERE EXCITED WITH ELECTRIC
CURRENTS AND MAGNETIC FLUXES

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 22, No 9, Sep 77 pp 1829-1837 manuscript received 17 Jan 77

FEL'D, YA. N. and FEL'D, S. YA.

[Abstract] The boundary-value problem of a sphere excited with arbitrarily given electric currents and magnetic fluxes is treated in terms of partial waves, according to the method of A. Sommerfeld. The set of Maxwell field equations in this representation is then integrated by the "variation of parameters" method, and the result extended from an ideally conducting sphere to a magneto-dielectric sphere. For comparison, this method is also applied to the excitation of an ideally conducting sphere by an electric dipole with a radially oriented moment. References 8: 6 Russian; 2 Western.

LEAKAGE FIELDS OF MAGNET HEADS WITH REDUCED ACTIVE SURFACE

Moscow RADIOTEKHNIKA in Russian Vol 32, No 9, Sep 77 pp 92-94 manuscript received 21 Jan 76; after completion, 18 Nov 76

KHALETSKIY, M. B., IVANOV, A. E., RAU, E. I. and IVANNIKOV, V. P.

[Abstract] The magnetic leakage field between two parallel parallelepipeds simulating the poles of a magnet head is calculated on the basis of the fundamental field equations. The resulting expressions indicate that: 1) The leakage field is strongest when the magnetization vector varies linearly across the depth of the pole shoe, 2) The gradient of the longitudinal component of the magnetic field intensity is maximum when the magnetization vector varies parabolically across the depth of the pole shoe, and 3) As the depth of the pole shoe is decreased, the intensity of the magnetic leakage field increases nonlinearly. In order to retain the required high mmf of film-type heads during recording, it is necessary therefore to minimize the depth of the pole shoe. These conclusions have been verified experimentally by reading out two-dimensional magnetic fields under a raster-type electron microscope with a special optoelectronic device. Figures 5; references: 4 Russian.

OPTIMIZATION OF A CORRELATIONAL SYSTEM OF IDENTIFYING A GAUSSIAN SIGNAL PAIR BY THE MAXIMUM-LIKELIHOOD CRITERION

Leningrad IZV.VUZ:PRIBOROSTROYENIYE in Russian Vol 20, No 7, Jul 77 pp 29-32 manuscript received 2 Dec 76

SEMUSHIN, I. V. Paper recommended by Chair of Computer Engineering, Ul'yanovsk Polytechnic Institute.

[Abstract] The problem is to establish, on the basis of their observed realizations, to which of two given classes (1 and 2) two Gaussian signals $x_1(t)$ and $x_2(t)$ with different cross-correlation coefficients $r_1 \neq r_2$ at the same instants of time belong. This is relevant to the identification of a Markov model of motion in control of dynamic systems, for instance, where class 1 corresponds to $r_1 = 0$ and class 2 corresponds to $r_2 \neq 0$. In order to construct an appropriate digital identification system, it is sufficient to optimize the test of the simple hypothesis $r = r_1 = 0$ against the simple alternative $r = r_2 \neq 0$. The problem is solved practically by calculating the threshold values and determining the sample volume as well as the sampling frequency. The general results are applied, for illustration, to a system which must be checked for discontinuity in the feedback loop. Figures 2; references 9: 8 Russian; 1 Western.

ELECTRICAL ENGINEERING
Equipment and Machinery

USSR

UDC [621.3.017.3:621.318.43]001.24

CALCULATION OF LOSSES IN MASSIVE STEEL PARTS LOCATED NEAR REACTORS

Moscow ELEKTROTEKHNIKA in Russian No 9, Sep 77 pp 59-60

ZHELEZNYAKOV, A. T., candidate in technical sciences

[Abstract] A study is made of the case when a reactor is installed on a steel sheet, as is the case when a reactor is placed on the cover of a transformer on an electric locomotive. Assuming that the height of the coils of the reactor is several times greater than the internal radius and thickness of the reactor windings, it is assumed that the induction in the axial direction is distributed trapezoidally. It is initially assumed that all of the flux flows through the steel sheet, and that the sheet is thick enough that the steel is not saturated. The rule of change of induction by radius is then determined. When two reactors are installed next to each other, the induction is determined, considering the mutual induction of the reactors by addition. A comparison with experimental values of induction heating of a steel sheet showed the calculated values of temperature to be 15-20 percent higher. Figures 1; tables 2; references: 3 Russian.

USSR/CUBA

UDC 621.313.33

PERFORMANCE CHARACTERISTICS OF [USSR] INDUCTION MACHINES OPERATING IN CUBA

Novocherkassk IZV.VUZ:ELEKTROMEKHANIKA in Russian No 8, Aug 77 pp 940-944

SARAGOSA, FLORENTINO SESMA

[Abstract] The climate in Cuba is characterized by a high humidity, up to 90 percent at night and in the morning, and wide temperature fluctuations about rather high average levels. Such conditions are conducive to fungus growth and fast aging of insulation. The performance of standard USSR induction motors has been evaluated in terms of torque vs. speed, efficiency vs. load, and transient current vs. time characteristics. Calculations based on the equivalent circuit diagram to a per-unit scale indicate that such motors, when exported to Cuba and operating there, will deliver much lower starting, pullout, and running torques with a much higher inrush current and a longer acceleration period at 220 V 60 Hz; and slightly lower torques with a higher inrush current and a longer acceleration period at 440 V 60 Hz. Modification of the coil design to suit the climatic conditions in Cuba will appreciably affect the starting performance. The motors must also be totally enclosed, have a varnish coated insulation, and all components sterilized against fungus. All motor rooms must be adequately ventilated. Figures 5; tables 1; references: 4 Russian.

USSR

UDC 621.316.718.5

METHODS OF PHASING A SPEED STABILIZATION SYSTEM FOR HYSTERESIS MOTORS

Leningrad IZV.VUZ:PRIBOROSTROYENIYE in Russian Vol 20, No 7, Jul 77 pp 37-42
manuscript received 23 Jun 76

TANSKIY, YE. A. Paper recommended by Chair of Automation and Telemechanics,
Leningrad Institute of Precision Mechanics and Optics

[Abstract] The speed of hysteresis motors in opticommechanical instruments is usually stabilized by phasing. Hysteresis motors operating from a drive generator with phase control are considered, with the speed stabilization system including a frequency divider, a phase discriminator, a corrective network, a phase shifter, and a feedback transmitter. With the proper switching, the phase of either the pulse train at the input of the frequency divider or the pulse train at the input to the phase discriminator can be changed, or both can be changed simultaneously, depending on the system application and characteristics. On the basis of the system equations for each phasing mode, the steady state of the system before and after phasing is determined graphically. The results indicate that simultaneous phasing of both pulse trains occurs without a transfer of the equilibrium point from one to the other branch of the discriminator characteristic. Figures 3; references: 3 Russian.

USSR

UDC [621.333.2-214.34:621.63:622.4].(083.75)

NEW STATE STANDARD GOST 22185-76, "THREE PHASE INDUCTION SHORTED EXPLOSION-SAFE VRM SERIES MINE MOTORS FOR TYPE VM AND VMTS LOCAL VENTILATION FANS"

Moscow ELEKTROTEKHNIKA in Russian No 9, Sep 77 pp 61-62

VAYSENGOL'TS, V. A., KRASNIKOV, G. V., BELAY, L. N., PESYUKOV, V. N. and OSIPOVICH, V. T., engineers

[Abstract] The new standard goes into effect on 1 January 1978, and reflects the achievements of the USSR and foreign electric engineering industry in the area of planning and manufacture of explosion-safe electric motors for coal mine ventilation apparatus. It covers motors of 2.2-110 kW power, designed to be supplied with 50 Hz AC power, and establishes types, basic parameters and dimensions, technical requirements, safety requirements, equipment to be supplied, acceptance rules, methods of testing, marking, packaging, transportation, storage and guarantees. The standard considers the general technical requirements of GOST 21403-75 for similar motors of 0.25-110 kW power ratings plus GOST 183-74 for rotating electrical machines in general, and establishes a number of additional requirements for motors to be used for local ventilation purposes. The standard establishes the following reliability requirements; mean time to first overhaul 30,000 hours, MTBF at least 15,000 hours. The program of periodic testing calls for testing of the motor together with the fan for heating at nominal operating speed and voltage and at maximum throughput with 10 percent lower than nominal voltage, as well as 50 percent throughput, the low end of the operating range. Figures 1; tables 2.

USSR

UDC 621.385.6

THE PROBLEM OF THE MAXIMUM AMPLIFICATION BAND OF A CRM TWISTRON

Gor'kiy IZV.VUZ:RADIOFIZIKA in Russian Vol 20, No 8, 1977 pp 1218-1223

manuscript received 6 Oct 76

MOISEYEV, M. A., Scientific-Research Institute for Radio Physics

[Abstract] The efficiency, band width and gain of a CRM twistron with output sections in the form of semi-infinite regular wave guides and a homogeneous longitudinal static and magnetic field are determined. The study was performed using the CRM equations with nonfixed structure of the high-frequency field produced in an earlier work by the author et al. The length of the drift space is assumed much greater than the areas of interaction of electrons with continuous field in sections. This allows the influence of variations in electron velocity on their grouping to be considered only in the drift space. Optimal tuning of the magnetostatic field corresponds to the minimum of I_{st} , while I_{opt} corresponds to approximately double the value of I_{st}^{min} defined in the work where $r = 0$. Expressions are presented which can be used for approximate design of CRM twistrons. The author thanks V. L. Bratman and V. K. Yulpatov for helpful council. Figures 4; references: 9 Russian.

USSR

UDC 621.385.6

LOW FREQUENCY FLUCTUATIONS OF OSCILLATIONS IN A CRM MONOTRON

Gor'kiy IZV.VUZ:RADIOFIZIKA in Russian Vol 20, No 8, 1977 pp 1209-1217

manuscript received 11 Mar 76

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[Abstract] Low-frequency fluctuations in a CRM monotron resulting from slow fluctuations in the current of the electron beam, and the electric and magnetic fields forming the beam are studied. The study is performed by simultaneous solution of abbreviated equations for the electromagnetic field and nonlinear equations of motion of electrons in the high-frequency field. Equations are produced which allow the spectral densities of amplitude and frequency fluctuations to be determined if the conductivity of the resonator and the assigned spectral characteristics of the fluctuating parameters are known. A quantitative estimate of the proportionality factors between the spectral densities of fluctuations of the parameters and the output signal is performed for a CRM monotron with optical parameters allowing the maximum value of transverse electron efficiency to be achieved. It is found that the proportionality factors between the spectral densities of low-frequency fluctuations in the parameters and the amplitudes of oscillations in the optimal operating mode of the CRM monotron depend only on the strength of the limiting cycle $p = \omega/Q$. Figures 5; references: 5 Russian.

USSR

UDC 621.385.69

A GENERATOR OF DIFFRACTION RADIATION OPERATING ON THE SECOND SPACE HARMONIC

Kiev IZV.VUZ:RADIOELEKTRONIKA in Russian Vol 20, No 7, Jul 77 pp 130-132
manuscript received 14 Jul 75; after revision, 20 Dec 76

REVIN, I. D.

[Abstract] A second-harmonic generator of diffraction radiation was designed and built for an average frequency on the order of 75 GHz, in the form of an open resonator. The latter consisted of one spherical reflector and one cylindrical reflector, with a rectangular aperture and with the distance between them variable from 19 to 23 cm, with the diffraction grating having a period matching the second space harmonic soldered to the cylindrical reflector along its generatrix. The electron flux, $0.2 \times 5 \text{ mm}^2$ in cross section, was generated by a diode gun and shaped in a permanent magnetic field 3.8 kOe strong. The maximum output power of 0.6 W was obtained at 80.2 GHz with an accelerating voltage of almost 3 kV, also matching the second space harmonic, at an anode current of 210 mA. An experimental evaluation of this device revealed that its Q-factor remains high and no backward-wave mode occurs, unlike the case of a diffraction grating designed for the fundamental component of the spatial distribution. Therefore, despite the somewhat lower output power, this device seems better suitable for operation in the submillimeter range of wavelengths. Figures 3; references 6: 5 Russian; 1 Western.

USSR

UDC 621.385.633

AUTOMATIC PHASE TUNING SYSTEM FOR FREQUENCY OF BACKWARD WAVE TUBES WITH
AUTOMATIC ACQUISITION OF SYNCHRONISM

Moscow IZV.VUZ:RADIOELEKTRONIKA in Russian Vol 20, No 8, Aug 77 pp 110-111
manuscript received 24 May 76

SEMENKO, A. I.

[Abstract] A phase automatic frequency tuning system for backward wave tubes is analyzed in which acquisition of synchronism following mistuning which exceeds the capture band is automatically achieved. The automatic search device is put into operation by a variable voltage at a beat frequency which appears at the output of the phase discriminator if capture does not occur after a mistune. Figures 2; references: 3 Russian.

General Production Technology

EAST GERMANY

RELIABLE CONSUMER PRODUCTS REQUIRE RELIABLE SOLID-STATE COMPONENTS

East Berlin RADIO FERNSEHEN ELEKTRONIK in German Vol 26, No 2, Jan 77 pp 41-42

KLITZKE, JOACHIM, and STRAUBE, ROLF

[Abstract] New consumer electronic products increasingly use such advanced components as analog bipolar integrated circuits, bipolar Si transistors, and Si rectifiers. Industry and quality-control organs established a set of criteria for these components so as to ensure the reliability of the consumer products in which they are used. In order to meet these criteria, measures were introduced in the manufacture of circuit boards (cleanliness, ingredient purity, process control, electrical parameters), in the assembly and checkout of the components (proper adjustment, contact quality, wiring, and calibration of the instruments used in the adjustments and checks), and in the final testing of the finished products (establishment of compliance with all specified performance requirements, reject analysis, and periodic calibration of the test instruments). Analysis of the reject causes permits improvements in the manufacturing process to be implemented. Most rejects were caused by improper wiring, displaced bond sites, bond defects, and substrate defects. Appropriate measures (such as changed control procedures, staff refresher courses, and the like) are instituted on the basis of the results of the reject analyses. The Semiconductor Works Combine State Enterprise in Frankfurt/Oder implemented the above principles with success. Figures 2; tables 2; references: 3 German.

EAST GERMANY

ACCELERATED RELIABILITY TESTING OF ELECTRONIC COMPONENTS AND DEVICES

East Berlin RADIO FERNSEHEN ELEKTRONIK in German Vol 26, No 2, Jan 77 pp 43-44

KIESSLING, KARL GEORG, graduate engineer

[Abstract] This article is the text of the author's paper delivered at the Conference on the Accelerated Reliability Testing of Electronic Components and Devices, held in May 1976 at Zielona Gora, sponsored by East-German and Polish associations. Accelerated reliability testing is based on the fact that the failure rate rises exponentially with an increase in the severity of stresses and exposures. The failure mechanisms are always based on chemical and/or physical processes, which are known to accelerate with increasing temperature. Increased service temperature develops from the ambient temperature and heat generated by the operating device. The energy conversion form plays an important role. Thus, many reliability tests can be based on simulation of the increasing stresses and exposures by increased test temperature.

Studies on capacitors confirmed the validity of this approach. It was found that a temperature increase of 20°K above the maximum service temperature is a guideline value for adequate reliability tests. Increased atmospheric humidity makes the reliability test conditions even more realistic. Finally, shock and vibration tests may be also carried out. Figures 7; references: 10 German.

STATUS AND PROSPECTS OF SCIENTIFIC RESEARCH IN THE AREA OF INDUSTRIAL
APPLICATION OF STRONG ELECTRIC FIELDS

Moscow ELEKTRICHESTVO in Russian No 9, Sep 77 pp 1-8

POPKOV, V. I., Academician, LEBITOV, V. I., dr in technical sciences,
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technical sciences, Moscow

[Abstract] An analysis is presented of the status of theoretical study in the area of electrodynamics and gas dynamics of dispersed systems. The prospects for industrial application of electron-ion processes are discussed. Advances in the area of calculation of corona-discharge electric fields are discussed. In addition, electrostatic induction and static electrification methods of charging particles are described. The regularities of movement of charged particles in electric fields in turbulent gas streams have been extensively investigated both in the Soviet Union and abroad, and the results are summarized. Electric gas filtering, electric painting and dusting, electric separation and the use of strong electric fields in agriculture for such processes as pest elimination, preplanting treatment of seeds, cleaning of cotton, etc., are discussed. References 27: 26 Russian; 1 Western.

USSR

UDC 621.3.048

A SHIELD FOR PROTECTION OF PERSONNEL FROM THE EFFECTS OF AN ELECTRIC FIELD WHEN WORKING ABOVE THE GROUND

Moscow ENERGETIK in Russian No 7, Jul 77 pp 17-18

MOISEYEV, A. G. and STOLYAROV, M. D., engineers

[Abstract] Usually, persons working above ground level in the electric fields generated by high voltage power transmission lines are protected from the harmful effects of such fields by shielding suits. However, if the workers are elevated to the working location in mechanical devices ("cherry pickers," etc.) simple removable shields installed in the buckets of the mechanisms during the time of work in the zone of influence of the electric field can be used. One such simple device is illustrated, consisting of a steel ring held above the bucket by four uprights. Chains are suspended from the steel ring to form a shielding cylinder. A double cylinder of chains is used, with the inside chains filling the gaps between the outside chains. Each quarter section of the curtain can be lowered, the chains folding into a trough at the bottom of the bucket to allow the worker to perform his work while the remaining three-fourths of the screen stay in place to protect the worker from the effects of the high voltage field. Figures 1.

USSR

UDC 621.315.1.027.8/88.004

EVALUATION OF HYGIENIC NORMS BENEATH SUPER HIGH VOLTAGE POWER TRANSMISSION LINES

IZV.VUZ:ENERGETIKA in Russian No 8, Aug 77 pp 118-121 manuscript received 14 Jan 77

IVANOVA, S. N., engineer, and GONCHARIK, YE. P., candidate in technical sciences, Belorussian Polytechnical Institute

[Abstract] In order to establish the effect on operating personnel of the high voltage electric fields existing beneath power lines, a series of experiments was performed beneath overhead lines at 330 kV substations and the results of experiments beneath the 750 kV power line between Konakov and Moscow were used. The current flowing from a man standing vertically with his hands at his sides was measured by a shielded microammeter which was grounded, the subject standing on an insulator. As a result, an empirical relationship was determined between the electric field intensity at the level of the height of a man and the current induced by this field in the body of a man standing on the ground: $I/E = h/9 - 7.34 \mu A/kV/m$ where I is the current flowing through the subject, E is the electric field intensity, h is the height of the man in cm. Thus, if a meter is not available to measure directly the electric field intensity, a microammeter can be used to measure the current flowing from a man standing under the line to ground, and thus the field intensity can be estimated. Figures 2; references: 3 Russian.

USSR

UDC [621.315.1:537.212].001.24

CALCULATION OF CHARGES INDUCED IN THE WIRES OF OVERHEAD POWER TRANSMISSION
LINES BY AN EXTERNAL ELECTRIC FIELD

Moscow ELEKTRICHESTVO in Russian No 9, Sep 77 pp 70-72

KOLECHITSKIY, YE. S., candidate in technical sciences, YELISEYEV, YU. V. and
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[Abstract] The charges induced in power transmission lines by lightning bolts, thunder clouds and other external factors can cause overvoltages and may determine the point where lightning will strike a power line. This article presents a method of calculating the charge induced in overhead power lines by such external electric fields, and presents two calculation examples. Figures 3; tables 1; references: 3 Russian.

USSR

UDC 621.315.1:681.142.35

USE OF ELECTRONIC COMPUTERS FOR ACCOUNTING AND ANALYSIS OF REPAIR WORK ON
6-10 kV POWER TRANSMISSION LINES

Moscow ENERGETIK in Russian No 7, Jul 77 pp 22-23

KARASEV, D. D., SHUMILOV, V. A., candidates in technical sciences, IVANOV,
G. A. and MARKOV, V. S., engineers

[Abstract] The "electrical systems" department of the Smolensk Affiliate of the Moscow Power Engineering Institute has developed a system of collection and processing of information on repairs of 6-10 kV power transmission lines utilizing an M-222 computer. Information is recorded on a special reporting card or transmitted by teleprinter and input to the computer from the punch tape produced by the teleprinter. One important property of the software used in the system is the possibility of selective analysis of repair work performed. Accumulation and processing of information on power transmission line repairs using the system allows rather complete analysis of the economic activity of the repair personnel, with reports generated on work performed in order to allow improvement of planning of power lines distribution network maintenance.

CSO: 1860

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