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ELECTRONICS AND ELECTRICAL ENGINEERING

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UDC 531.383

NONLINEAR ERRORS OF DOPPLER SONAR LOG CAUSED BY SHIP ROCKING

Leningrad IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: PRIBOROSTROYENIYE in Russian Vol 26, No 11, Nov 83 (manuscript received 23 May 83) pp 51-54

VINOGRADOV, Yu. L., OKRUZHNOY, P. L. and TARAN, Yu. A., Ryazan Institute of Radio Engineering

[Abstract] The accuracy of a Doppler sonar log which determines a ship's location and measures its horizontal velocity component under conditions of simultaneous rolling and pitching in the presence of a vertical velocity component is analyzed in two orthogonal systems of Cartesian coordinates: one stationary tied to the earth and one moving tied to the ship. The errors of average readings are found to depend on the rolling amplitude and the vertical velocity component as well as the phase relation between them. The adcuracy of velocity measurement by the Doppler method also depends on the depth, inasmuch as the time of signal travel to and from the sea bottom depends on the depth of the bottom as well as on the angles of pitch and roll. On the basis of these considerations, the effect of ship rocking on the performance of a Doppler sonar log has been evaluated by computer simulation with quadrature resolution of the antenna beams in the pulse mode of operation. Numerical estimates of relative velocity errors have been obtained for appropriate correction, preferably by the ship computer. The paper is recommended by the Chair (Kafedra) for Designing of Electronic-Computing Equipment. Figures 1; references 3: 2 Russian, 1 Western.
[87-2415]

UDC 621.396.677

SYNTHESIS OF ANTENNAS WITH WEAK SUPERDIRECTIVITY

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 28, No 10, Oct 83 (manuscript received 10 Mar 82) pp 1900-1906

POLISHCHUK, I. M.

[Abstract] An antenna with an aperture surface utilization factor larger than unity is rigorously synthesized on the basis of relations for weakly superdirectional antennas and the field distribution in their apertures. The procedure is demonstrated on a two-dimensional antenna radiating through a slot along the lateral surface of a straight circular cylinder. The amplitude-phase distribution in this aperture is calculated, as well as the correction factor by which it differs from a plane field distribution. The correction factor is treated as a slowly varying one so as to take into account constraints on the Q-factor and the feasibility of realizing the desired field distribution by means of two geometrical mirrors inside the cylinder. The results reveal that shadowing reduces the surface utilization factor, and also that the phase of the correction factor varies hardly at all over the aperture region where the field amplitude is high. The surface utilization factor can, therefore, be increased only through an increase of the field amplitude. Figures 4; references: 8 Russian.
[84-2415]

UDC 621.396.96/75

ANGLE RESOLUTION OF WIDEBAND SIGNALS RECEIVED BY TWO SLIGHTLY DIVERSE LINEAR ANTENNA ARRAYS

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 28, No 10, Oct 83 (manuscript received 22 Jan 82) pp 1926-1930

BAGDASARYAN, S. T. and ZINEVICH, Ye. P.

[Abstract] The problem of angle resolution is considered in the case of detection of wideband signals by means of antenna arrays with a discontinuous

aperture. The receiver antenna is assumed to be linear and to consist of two separate equidistant arrays of weakly directional elements. The signals are assumed to appear at the receiver on plane electromagnetic waves together with interference and intrinsic noise, both centered stationary Gaussian random processes. Expressions are derived for the energy utilization factor, characterizing the signal-to-(noise+interference) ratio relative to the signal-noise ratio without interference. A comparison of that energy utilization factor corresponding to optimal processing of a narrow-band signal and to nonoptimal processing of a wideband signal, respectively, yields the dependence of detectability and angle resolution on the signal bandwidth and the angular spacing of signal sources. The authors thank V. S. Chernyak for helpful comments. Figures 2; references 9: 8 Russian (including one item concerned with foreign electronics); 1 Western.
[84-2415]

UDC 621.371.334.535.24

THERMOSCOPIC STUDY OF DIFFRACTION CURRENT DISTRIBUTION

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 28, No 10, Oct 83 (manuscript received 10 Nov 81) pp 2057-2060

GORGOSHIDZE, A. N. and KHVOROSTYANOV, Yu. I.

[Abstract] The distribution of induced current over the surface of a body can be measured with infrared instruments which record the temperature increases resulting from heating in a high-frequency electromagnetic field. The principle of this method is based on the theory of heat emission and absorption with diffraction, and on the electromagnetic field theory, taking into account the skin effect and the Joule effect. The recording instruments must be designed accordingly, with a "black" sensor material, and used under conditions where the body surface temperature does not exceed half the equilibrium temperature at which all absorbed electromagnetic energy is reemitted into free space as thermal radiation. The recorded thermal image of the diffraction pattern corresponds to the surface distribution of the electric-current amplitude squared, provided that the conditions for localizability of heating are maintained by making the irradiation time longer than the characteristic time for normal heat transmission to the surface and shorter than the characteristic time of heat transmission along the surface. The method has been proved on model bodies of elementary shapes such as a sphere, a rectangular strip, and a cone, by means of calibration against other known approximate experimental methods and against exact solutions to corresponding diffraction problems. The authors thank P. Ya. Ufimtsev for his interest. Figures 2; references 7: 5 Russian, 2 Western (1 in Russian translation).
[84-2415]

UDC 621.396.67.01

CONCERNING POWER RECOVERED BY RECEIVING ANTENNA FROM INCIDENT FIELD

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 28, No 12, Dec 83
(manuscript received 25 Feb 83) pp 2313-2319

FEL'D, Ya. N.

[Abstract] The paper considers the problem of the power entering a receiver with a random (not necessarily plane) wave incident to the antenna. The problem, previously studied by E. L. Burshteyn (in 1958) and B. Ye. Kinber (in 1961), is reconsidered in order: 1) To establish under which conditions the Burshteyn-Kinber formula is correct for power entering a receiver; 2) To obtain a formula which takes into account the effect of mismatch of the feeder line with the antenna and receiver; 3) To give another, simpler version of the formula; and 4) To evaluate the upper boundary of the power entering the receiver with a given incident field and some additional conditions, and to find the distribution of the antenna field (in a transmission regime), guaranteeing realization of the boundary mentioned. An antenna in the form of a horn with a waveguide transmission line was used in the experiment. Figures 2; references: 4 Russian.
[104-6415]

UDC 537.874.4

INTENSITY OF RADIOWAVE SCATTERING ON ANISOTROPIC IRREGULARITIES WITH VARIOUS POSITIONS OF SCATTERING VOLUME ABOUT CAUSTIC ZONE

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 28, No 12, Dec 83
(manuscript received 5 Apr 82) pp 2320-2329

NAMAZOV, S. A.

[Abstract] The paper obtains the necessary relations in a Born approximation and analyzes the characteristic properties of the perspective scattering of radio waves on arbitrarily oriented anisotropic irregularities in a stratononhomogeneous medium with various azimuths of both incident and scattered waves. The following items are considered: 1) Intensity of scattering on anisotropic irregularities; 2) Scattering in an illuminated area; 3) Dispersive extent in area of shadow; and 4) Effect of caustic zone on a stray field. The Born approximation obtained contains an expression for the intensity of radio wave scattering from anisotropic irregularities (extended along magnetic field), taking into account the dependence of scattering on the magnetic inclination and azimuth of the incident wave. An analysis is presented of scattering at irregularities located above, below, and at the level of reflection. Figures 3; references: 7 Russian.
[104-6415]

UDC 537.874.35

REFLECTION OF ELECTROMAGNETIC WAVES FROM INHOMOGENEOUS MEDIA

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 28, No 12, Dec 83
(manuscript received 16 Apr 82) pp 2330-2335

STOLYAROV, S. N. and FILATOV, Yu. A.

[Abstract] The paper proposes a method for an approximate analytical calculation of the reflection factor of electromagnetic waves from layers with a variable refractive index of an arbitrary form. The proposed formulas agree well with the known results of a calculation of the reflection factor for a wide class of dependences of the refractive indices. It is possible to use the formulas during calculation of the reflection of obliquely incident waves. The methods described can be used to calculate conversion of waves in homogeneous transient media. The authors thank R. L. Yevel'son for discussion of the work and for helpful remarks. References 11: 8 Russian, 3 Western (in Russian translation).
[104-6415]

UDC 621.372.852.2

OPTIMUM SYNTHESIS OF STEPPED SECOND CLASS PHASE-SHIFTERS

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 28, No 12, Dec 83
(manuscript received 22 Mar 82; after correction, 8 Feb 83) pp 2341-2346

MESHCHANOV, V. P., METEL'NIKOVA, I. V., and FOKEYEV, L. G.

[Abstract] The paper investigates a new structure for the electrical circuits of phase-shifters. The object of this is to obtain an optimum synthesis of stepped second class phase-shifters. The base of the new structure is a cascade connection of lengths of connected and nonconnected lines, the length of which varies. The coupling coefficients of the lengths of connected lines are identical and the overall number of lengths of connected and nonconnected lines is always odd. An evaluation is made of the results obtained, tables of the parameters are presented, and a classification of stepped phase-shifters is introduced. Figures 2; tables 4; references 10: 6 Russian, 4 Western.
[104-6415]

UDC 621.396.677.49:510.53

RELATIONS BETWEEN ALGORITHMS OF ADAPTIVE OPTIMIZATION OF ANTENNA ARRAYS AND ALGORITHMS OF OPTIMUM DETECTION OF MULTIDIMENSIONAL STOCHASTIC SIGNAL

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 28, No 12, Dec 83 (manuscript received 17 Nov 81) pp 2366-2372

GUSEV, V. G. and CHERENKOVA, Ye. V.

[Abstract] In many instances, complete utilization of the physical possibilities for optimization of information processing algorithms must take into account not only the time but also the spatial difference of the signal and noise. This leads to consideration of systems of space-time processing of input information, the characteristics of which are usually assigned to the elements of the antenna array. Processing of input information in adaptive antenna systems is accomplished with the assistance of a pulse vector-function multiple (according to the number of elements of the array) filter which processes information from the outputs of the antenna array. The strict solution obtained in this paper for the problem of synthesis of algorithms for processing information in antenna arrays makes it possible to clarify the relations between these algorithms and the algorithms of optimum detection of a multiple stochastic signal. Figures 2; references: 13 Russian (2 concerned with foreign radio electronics).
[104-6415]

UDC 621.391.161

AUTOCORRELATION RECEIVER FOR DOPPLER SHORT-RANGE RADAR SYSTEMS

Kiev IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: RADIOELEKTRONIKA in Russian Vol 26, No 12, Dec 83 (manuscript received, after revision, 4 Mar 83) pp 26-30

KRYZHANOVSKIY, V. L. and STEFANISHIN, Ya. I.

[Abstract] An autocorrelation doppler frequency receiver is theoretically and experimentally investigated. It is shown that the structure of a Doppler frequency meter of the autocorrelation type makes it possible to decrease the required signal-to-noise ratio at the input of the meter to 2.5-3. In this case the optimum ratio of the levels of operation of the two shapers, with the probabilities of false alarms and the admission of a signal equal to 0.01; $U_2/U_1 = 2.5$. Such an autocorrelator makes it possible to exclude inaccurate measurement of the frequencies of the Doppler signal and to increase the minimum range of the equipment of short-range radar. Figures 4; references: 4 Russian.
[106-6415]

UDC 621.396.669.8

THRESHOLD SIGNALS FOR DETECTOR HAVING STABILIZATION OF FALSE ALARM PROBABILITY

Kiev IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: RADIOELEKTRONIKA in Russian
Vol 26, No 12, Dec 83 (manuscript received, after revision, 31 Jan 83)
pp 53-55

PLUZHNIKOV, A. D. and SAVCHENKO, V. V.

[Abstract] A "rigid" amplitude limitation (RAL) or an automatic gain control (AGC) are widely used for stabilization of false alarm probability during detection of radar signals on a background of nonstationary noise with a variable intensity or a stationary noise and unknown intensity. RAL, in contrast to AGC, makes it possible to protect the detector from impulse noise, i.e., to stabilize also the false alarm probability during its action. However, in a number of cases, the "quasi-linearity" of AGC systems makes them more favorable. Moreover, by combining a standard AGC system with known devices for suppression of impulse noise, it is possible to protect the AGC itself and the detector on the whole from this noise. It is shown that by employing an AGC it is possible to achieve stabilization of false alarm probability during detection of signals, masking not only the noise which has unknown or variable intensity but also impulse noise. At the same time a quality of detection, close (with a magnitude near threshold signals) to that realized in the case of a solution of the same problem with the aid of "rigid" amplitude limitation. Figures 3; references: 6 Russian. [106-6415]

UDC: 681.325.5:681.513.6

ADAPTIVE ANALOG-TO-DIGITAL CONVERTER

Leningrad IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: PRIBOROSTROYENIYE in Russian Vol 27, No 1, 1984 (manuscript received 19 Sep 83) pp 52-56

[Article by Ye. L. Kon, N. N. Matushkin and A. A. Yuzhakov, Perm Polytechnical Institute, recommended by the Department of Automation and Telemechanics]

[Text] A method is proposed for constructing an adaptive analog-to-digital converter (A/DC). It was demonstrated that the use of such an A/DC reduces significantly the renundance of measurement information and increases accuracy of conversion.

As we know, about 90% of the expenses for obtaining and processing measurement information [1] in telemeasuring systems is spent on redundant information. For this reason, the problem of compressing data is very pressing in this field.

If input signal X is approximated with a certain function $f(x)$, the digitization interval and, consequently, conversion time for uniform temporary digitization (UTD) are determined on the basis of maximum value of modulus $(p + 1)$ of the derivative approximating function of the measured process [1]. The restriction of the conversion interval leads also to restriction of the bit configuration of the A/D converter. Thus, by changing modulus $(p + 1)$ of the derivative it is also possible to change conversion time, which also means change in number of bits, i.e., a change to adaptive (nonuniform) temporary digitization (ATD). For this reason, construction of an adaptive A/D converter makes it possible to reduce the redundancy of measurement information and increase the resolution of the converter.

A criterion has been proposed in [1] for optimizing A/DC, which does not take into consideration the error introduced by the dead time scaled to optimum number of bits. For this reason, we have used here the criterion developed in [1], but with consideration of additional error due to net lag.

We shall discuss here synthesis of an adaptive analog-to-digital converter (AA/DC) with a series-parallel operating algorithm, as well as analyze the proposed type of AA/DC according to the above optimization criterion.

Let us take a function of the following type as the optimization criterion:

$$\Delta_{\Sigma} = \Delta_{ап} + \Delta_{кв} + \Delta_{д} = \frac{k_p \Delta t^{(p+1)} M_{p+1}}{U_{x\,max}} + 2^{-q-1} - \min, \qquad (1)$$

where Δ_{Σ} is the adjusted overall error of conversion, $\Delta_{ап}$ is adjusted error of approximation of monitored process, $\Delta_{кв}$ is adjusted error of quantization of A/D converter, $\Delta_{д}$ is adjusted value of additional approximation error due to dead time in computer (BУ) of A/D converter, k_p is coefficient that depends on the type of approximation and order of approximating polynomial p, M_{p+1} is modulus $(p + 1)$ of derivative of signal in the interval Δt, Δt is the digitization interval, and $\Delta t = t_{пр} + t_{чз}$; $t_{пр}$ is A/D converter conversion time; $t_{чз}$ is the dead time, q is optimum number of bits in A/D converter that minimizes Δ_{Σ}.

The value of overall error Δ_{Σ} is minimal when the product of multiplying overall error by number of bits in parameter code of chosen base for A/D conversion equals zero, i.e.,

$$\frac{d\Delta_{\Sigma}}{dq} = 0. \qquad (2)$$

In order to find the solution to equation (2) it is necessary to determine $t_{пр}$ as a function of number of bits in the A/D converter code, i.e., $t_{пр} = \varphi(q)$. The effect of number of A/DC bits on measurement interval depends on the conversion method used. With use of the parallel method of conversion, $t_{пр}$ is constant and does not depend on q. Such converters have the fastest action, but also require considerable instrumentation expenses. Use of methods of series conversion and series-parallel conversion minimizes instrument expenses but slows down operation, and $t_{пр}$ is a function of q [2]. From these points of view, the series-parallel conversion method is the most promising [3]. A/D converters were built on the basis of this conversion method [4, 5], and they are the basis of the adaptive A/D converter we are discussing.

Analysis of the above-mentioned structures of the A/DC enabled us to determine conversion time in function q, which is determined in the following manner:

$$t_{пр} = 2t_{п} + t_{сч} + t_{п1}\left\{1 + \frac{k_{п}\left[\left(\frac{U_x}{\left]\frac{U_x}{U_{x\,max}\,2^{n}}\right[}\right) - \frac{U_{x\,max}}{2^{n}}\right]}{1/2^{m}}\right\}, \qquad (3)$$

where $t_{п}$ is aperture time of conversion of "rough" scale; $t_{п1}$ is aperture time of conversion of "precise" scale; $t_{сч}$ is time for transcribing codes in computer of A/D converter, and the number of bits in the computer is at least equal to maximum number of positions in the A/D converter counter; U_x is current value of converted input signal; q is number of bits in A/D converter code and $q = n + m$; n is number of bits on "rough" scale; m is number of bits on "precise" scale;][is operation of determining whole part of expression; $k_{П}$ is the coefficient of proportionality, and it equals $2^{n}/U_{x}$ max.

For the proposed adaptive A/D converter, $t_{чз}$ is a constant and characterizes time of measurement $\Delta_{ап}$, time of calculation of $q_{опт}$, time of commutation of inputs of "precise" scale counter and time of input-output of measured value of $\Delta_{ап}$ and calculated value of the model:

$$t_{чз}=\text{const.} \tag{4}$$

Substituting (3) and (4) in (1) and having solved equation (2) for q with restriction of the type of $q_{опт} = n + m_{опт}$, n = const, m = var (i.e., in the proposed adaptive A/D converter one can change the number of bits on the "precise" scale, effecting the series method of conversion), we shall have:

$$q_{опт} = \log_2\left(\frac{1}{4\Delta_{ап}(p+1)} + \sqrt{\frac{1}{16\Delta_{ап}^2(p+1)^2} + \frac{2t_n + t_{сч} + t_{чз} + t_{n1}}{2n_{ап}(p+1)\,t_{n1}2^{-n}B}}\right), \tag{5}$$

where

$$B = \frac{\frac{U_x}{U_{x\,max}}2^n}{\left]\frac{U_x}{U_{x\,max}}2^n\right[^{-1}}.$$

Thus, if we know the current value of $\Delta_{ап}$ we can determine the optimum number of bits in the A/D converter. Figure 1 illustrates the structure of an adaptive A/D converter.

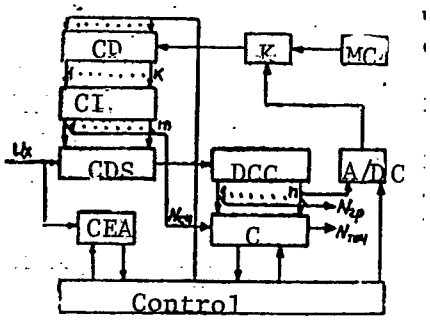

Figure 1.
Block diagram of adaptive A/D converter [abbreviations explained in the text]

This AA/DC operates in the following manner. The converter of error of approximation (CEA) continuously analyzes the current value of $\Delta_{ап}$. At the time of termination of the preceding cycle, information about $\Delta_{ап}$ passes to the computer (C) which determines $q_{опт}$ according to equation (5) and $m_{опт} = q_{опт} - n$. In accordance with the computed value for $m_{опт}$, the control device gives a specific input of the counter (CI) through coder (CD). The read-out A/DC is gated and, as a result, the "rough" value $N_{гр}$ is obtained for the measured parameter U_x. Then the master clock (MC) is started with key K and the CI counter starts to fill. A change in status of the counter leads to change in coefficient of division of the controlled digital subgroup (CDS). As a result of this, signal U_x at the A/D converter input starts to diminish. At the time of change in the smallest bit of the reading A/D converter, the digital comparison circuit (DCC) operates

and shuts off key K. The measurement process is over. $N_{Гр}$ and $N_{Сч}$ go to the computer for computation of more precise value $N_{Точ}$ ($N_{Сч}$--counter code) of input signal U_x.

As a result of the calculation, an output length of variable length is formed at the output of the AA/DC, and its size changes as a function of nominal value of $q_{опт}$ and $m_{опт}$, and only the number of bits in the vernier part of the $N_{Точ}$ code changes. Thereafter, the conversion process is repeated.

Adaptive digitization reduces the number of signal counts. For quantitative estimation of this reduction one uses the compression coefficient [1]:

$$K_c = \lim_{T\to\infty} \frac{N_p(T)}{N_a(T)} = \frac{M[\Delta t]}{\Delta t} = \frac{f}{M[f]}, \qquad (6)$$

where Np(T), N_a(T) refers to number of counts with uniform and adaptive digitization, respectively, in time T; M[Δt] and Δt is mathematical expectation of adaptive digitization interval and uniform digitization interval, respectively; M[f] and f refer to mathematical expectation of frequency of adaptive and uniform digitization time.

As can be seen in formula (5), $q_{опт}$ is a function of a rather large number of variables. For this reason, we shall search for the solution to equation (5) within the limits of the following restrictions.

1. Input signal U_x and approximation error $\Delta_{ап}$ serve as independent random variables. For this reason M[q] = f(M[M_{p+1}], M[U_x]) [6].

2. The method of approximation is extrapolation with a "zero" polynomial, i.e., p = 0, k_p = 1.

3. When the A/DC is built using modern microcircuits of the 140, 133 and 589 series, we obtain the following values for time: t_n = 2.5 ns, $t_{Сч}$ = t_{n1} = 100 ns, $t_{чэ}$ = 1 μs.

4. We shall consider that there are 4 bits in the reading A/D converter, i.e., n = 4.

Figure 2 illustrates K_C as a function of mean value of $\Delta_{ап}$ and value of converted signal U_x. Use of adaptive digitization time also increases accuracy of conversion. It is suggested that the gain in conversion precision be estimated using the following coefficient:

$$K_{пт} = \frac{\Delta_\Sigma \text{ UDT}}{\Delta_\Sigma \text{ ADT}}$$

where Δ_Σ UDT and Δ_Σ ADT refer to overall conversion flaw with UDT (uniform digitization) and ADT (adaptive digitization), respectively. Δ_Σ ADT and Δ_Σ UDT are determined according to formula (1), and they differ from one another in that with UDT Δt = const and q = const, whereas with ADT Δt = var and q = var. Figure 3 illustrates $K_{пт}$ as a function of mean value of $\Delta_{ап}$ and magnitude of converted signal.

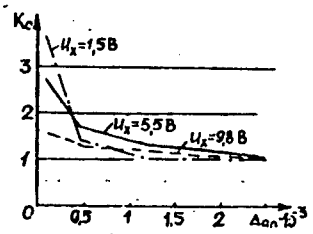

Figure 2.
K_c as a function of Δ_{an} and U_x

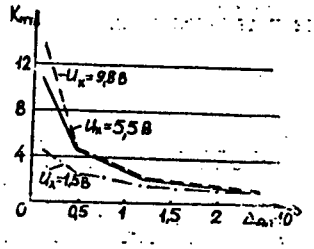

Figure 3.
$K_{пт}$ as a function of Δ_{an} and U_x

Thus, the proposed A/D converter with series-parallel algorithm of conversion makes it possible to combine the positive features of both parallel devices (high speed) and series (low instrument expenditures).

To search for $q_{опт}$ in AA/DC, it is expedient for expression Δ_{Σ}, which is proposed in [1], to add the component of dead time error that takes into consideration the time spent on finding $q_{опт}$.

Analysis was made of the coefficient of compression and increased precision for the proposed type of adaptive A/D converter, and determination was made of the ranges of Δ_{an} in which we have a gain for K_c and $K_{пт}$ under the adopted restrictions.

BIBLIOGRAPHY

1. Avdeyev, B. Ya., Antonyuk, Ye. M., Dolinov, S. N., Zhuravin, P. G., Semenov, Ye. I. and Fremke, A. V., "Adaptive Telemeasuring Systems," Leningrad, Energoizdat, 1981, pp 6, 227, 102.

2. Gitis, E. I. and Piskulov, Ye. A., "Analog-to-Digital Converters," Moscow, Energoizdat, 1981, p 10.

3. Aliyev, T. M., Damirov, D. I. and Shestikhalov, A. M., "Introduction to Algorithmic Bases of Digital Measurements," IZMERENIYE, KONTROL', AVTOMATIZATSIYA, No 3, 1981, pp 3-12.

4. Volkovoy, M. S., Kon, Ye. L., Matushkin, N. N. and Yuzhakov, A. A., Analog-to-Digital Converter (USSR Author Certificate No 834887)," BYULLETEN' IZOBRETENIY, No 20, 1981, p 200.

5. Idem, "Analog-to-Digital Converter (USSR Author Certificate No 706925)," Ibid, No 48, 1979, p 148.

6. Smirnov, N. V. and Dudin-Baranovskiy, I. V., "Course on Probability Theory and Mathematical Statistics (for Engineering Applications)," Moscow, Nauka, 1969, p 175.

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CSO: 8144/0887

NEW TELEVISION TRANSMITTER STATIONS

Moscow VESTNIK SVYAZI in Russian No 9, Sep 83 inside front cover, and outside and inside of back cover

POPOVICH, V. P., chief engineer, Main Management of Space and Radio Communication, USSR Ministry of Communications

[Abstract] Television enterprises of the USSR Ministry of Communication are being equipped with three new models of transmitter stations built by TESLA (Czechoslovakia). They are the TV20/4D 20 kW for channels IV-V (470-622 MHz), the TV5/1 5 kW for channels IV-V (470-622 MHz), and the TV1 1 kW for channel IV (470-630 MHz). The first two are built with the same standard components, including the dual TV/FM exciter as well as standby and control equipment, the only exception being their different klystrons: the 71ST53 klystron in the TV20/4D and the 60ST53 klystron in the TV5/1. The small TV1 has an altogether different structural layout and different performance characteristics. Here standby is eliminated; because of the relatively low power rating, the klystron output amplifier stage operates in the shared-amplification mode, the exciter is transistorized and modulation is effected at the intermediate frequency. The TV1 is designed so that it can also operate as a television relay, picking up programs from the nearest radio-television centers. A set of TMZ54 measuring instruments is used for both the TV20/4D and TV5/1 transmitters, and NFS1 audio and TVS1 video instruments are used for a TV1 transmitter. The audio power of the three transmitters is 2, 1, 0.1 kW, respectively. Their ranges of reliable reception from a 14 dB transmitter antenna with a 200 m high receiver antenna are 50-60, 30-35, 15-20 km, respectively. The transmitters weigh 9000, 6600, 2500 kg, respectively. Figures 5; tables 1.
[69-2415]

UDC 621.391.2

ACCELERATED SYNCHRONIZATION OF PSEUDORANDOM SIGNALS BY MEANS OF CONVOLVER AND RECIRCULATING DELAY LINE

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 28, No 10, Oct 83
(manuscript received 4 Feb 80, after revision 26 Nov 81) pp 2037-2041

KUZICHKIN, A. V.

[Abstract] An algorithm is proposed for fast synchronization of pseudorandom signals in a receiver with an acoustoelectric convolver as a matching input filter and with recirculating delay lines. Acceleration of the scan of pseudorandom signals is based on the use of special synchronizing sequences and on a polychotomic procedure, utilizing the linear dependence of the correlation peak amplitude on the difference between starting time of convolver output signal recirculation and delay-line output signal recirculation. In the preliminary stage of the algorithm compensation occurs of the time difference between short synchronizing signals for the reference signal and the input signal, respectively. In the main stages of the scan algorithm the period of time indeterminacy in the input signal is subdivided into p intervals at each step and the interval in which synchronism occurs is determined. The underlying principle is demonstrated on the simplest case of a dichotomic (p = 2) procedure. The efficiency of this algorithm in terms of mean scan time as a function the input signal-to-noise ratio is evaluated for the case of separate synchronizing and data transmitting signals with the phases of pseudorandom sequences bound to the instants of corssover from one law to another law of formation of short synchronizing signals, there being typically two orthogonal laws of cyclic repetition. Figures 2; references 10: 5 Russian, 5 Western (1 in Russian translation). [84-2415]

UDC 621.396.96:621.391.26

REGULARIZATION OF ALGORITHMS OF SIGNAL AND INTERFERENCE PROCESSING

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 28, No 10, Oct 83
(manuscript received 27 Sep 82) pp 2069-2071

RODIMOV, A. P., POPOVSKIY, V. V. and GLUSHANKOV, Ye. I.

[Abstract] Discrete recurrence algorithms of signal and interference processing through Kalman filtration in radar and communication systems, with both the state model $x(t)$ and the observation model $z(t)$ for estimating the useful signal given in the form of stochastic difference equations $x(k) = F(k)x(k-1) + G(k)w(k)$ and $z(k) = H(k)x(k) + v(k)$ where $w(k)$ and $v(k)$ denote zero-mean white noise, are efficient only in the case of exact fi ness of the selected statistical parameters. In the not uncommon case of an inadequate model, with incorrectly or inaccurately stipulated state and observation

matrices, it becomes necessary to ensure stability and convergence of the algorithm by some means. This can be done by regularization, which is much simpler than conventional parametric or nonparametric adaptation. It involves adding to the matrix $M(k) = H(k)P(k,k-1)H^T(k) + N(k)$ in the Kalman filtration algorithm, where $P(k,k-1)$ denotes the a priori dispersion of estimation error, the unit matrix E multiplied by the regularization factor $\alpha>0$. The estimation error $o(k)$ can be stipulated a priori or determined from the corresponding recurrence relation. The efficiency of thus regularized algorithms was evaluated by simulation on a YeS-1030 Unified System computer. The results indicate that regulatization can be regarded as a form of adaptation which ensures stability of an algorithm. Figures 1; references 7: 5 Russian, 2 Western (both in Russian translation). [84-2415]

UDC 621.391.837

STUDY OF TELEVISION SYSTEM WITH PRE-EMPHASIS AND DE-EMPHASIS BASED ON MULTIPLE SUBTRACTION AND LIMITATION

Moscow TEKHNIKA KINO I TELEVIDENIYA in Russian No 11, Nov 83 pp 32-35

ATAKHANOV, R. M. and MAMATKHODZHAYEV, V. N.

[Abstract] At present, improvement of the quality of reproducible TV images is a problem of current interest, particularly in connection with the development of systems for long-distance transmission of TV signals. Consequently, during perfection of an existing broadcasting network, improvement of its characteristics, in particular an increase of the signal-to-noise ratio and carrying capacity, is extremely important. The authors consider that one of the most effective and economical methods for a suitable solution of these problems is the use of pre-emphasis and de-emphasis on the basis of multiple subtraction and limitation of the signal. This makes it possible to reduce the dynamic range of the signal with pre-emphasis when transmitting the information concerning the steepness of abrupt contrast transactions via the additional channel. The authors believe that definite advances in the development and introduction of devices on the basis of this method already exist in three papers (R. M. Atakhanov, 1971; D. S. Lebedev, 1968; R. M. Atakhanov and E. B. Makhmudov, 1981). The principal factor restricting realization of such devices is the widening of the fronts of abrupt contrast transmission of an image, the so-called "overhead with respect to transconductance." The results of a system investigation on a simulated model are presented. Figures 5; references 10: 7 Russian, 3 Western. [114-6415]

UDC 621.397

PROSPECTIVE WAYS AND FORMS OF DEVELOPMENT OF TELEVISION BROADCASTING

Moscow TEKHNIKA KINO I TELEVIDENIYA in Russian No 11, Nov 83 pp 37-40

NOVAKOVSKIY, S. V., Moscow Electrotechnical Institute of Communications

[Abstract] At present, two versions are considered of the choice of the number of lines of future television systems--minimum (1125-1250 lines, image format K = 6/3 = 2, number of elements in image n = $1.5 \cdot 10^6$, frequency band of video signal 30 mHz), and maximum (2625-3125 lines, K = 6/3 = 2, n = $(8.11) \cdot 10^6$). An intermediate version at 1875 lines is also suitable for applied purposes. Figure 1 presents a maximum version; this version logically results from the dynamics of the preceding growth of television and the technically satisfactory base. The advisability of choosing 2625-3125 lines was considered earlier (in reports dated 1982 and 1983) and at present 2625 lines are proposed (in reports dated 1982 and 1983) as a world standard for television production of wideformat motion picture films (television cinematograph) with vertical arrangement of the scan lines, which makes it possible to transmit the video signal in a frequency band of not more than 34 MHz with an image format K = 7/3 = 2,35 and 25 frames/sec with the number of elements in the image n = $1.7 \cdot 10^6$. This problem is considered in detail. Variations of prospective television systems of increased sharpness are shown in a table. Figures 2; tables 1; references 8: 6 Russian, 2 Western.
[114-6415]

UDC 621.397.622:681.775.7

RELIEF-GRAPHICAL PROJECTION DEVICE FOR REPRODUCTION OF TELEVISION SIGNALS

Moscow TEKHNIKA KINO I TELEVIDENIYA in Russian No 11, Nov 83 pp 41-45

GUSHCHO, Yu. P., ALEKHIN, V. A. and LEVITSKAYA, Ye. A., Moscow Institute of Radio Engineering, Electronics and Automation

[Abstract] At present, high-quality television color images on a large screen can only be obtained with the help of the vacuum relief-graphical projectors "Eydofor" and "Ariston," serially produced since 1952. These projectors make it possible to obtain a color image on screens 100 m^2 and more with a high quality (luminous flux as high as 7000 lumen, resolution up to 1000 lines). The RJ-5000 and PJ-6000 systems, analogous with respect to principles but more compact, have only 500 lumen at the output and the resolution is limited to 525 lines. The high cost, bulk (the mass of the "Eydofer" projector is 700 kg), the complex technology of manufacture and the technic of exploitation prevent wide dissemination of these instruments. An attempt to develop laser systems for television receivers encounters the problem of line scanning. The present paper considers a device for reproduction

of color television signals, realized on the basis of a vacuumless relief-graphical light modulator with a relay-shaped (elastomeric) recording carrier. In the proposed device, which is described in detail, there is no horizontal scanning or the possibility of using laser and thermal light sources. The writers conclude that the theoretical analysis conducted as well as the breadboarding and experimental investigations made of the basic elements of the relief-graphic device for reproduction of television signals conforms the possibility of creating a new class of light-valve projectors using an unidimensional multichannel light modulator with a by-the-line electrical lead-in of a signal and an optical scanning frame. The relief-graphic phase light modulator with a gel-like deformable layer has the necessary high-speed response and resolution and makes it possible to transfer gradations of brightness, and to reproduce light images. It is also concluded that in a cylindrical Schlieren projector, it is possible to use both a laser and a noncoherent source of light. The converter of a television signal for parallel line-by-line location of information into a light modulator can be accomplished in integral fulfillment and constructionally united with the light modulator. Figures 8; references 15: 13 Russian, 2 Western (1 in Russian translation).
[114-6415]

UDC 621.397.331.29

LIGHT-EMITTING DIODE MATRIX FLAT SCREEN

Moscow TEKHNIKA KINO I TELEVIDENIYA in Russian No 11, Nov 83 pp 47-48

IONOV, N. P., KAZAKOV, B. V., LEONOV, V. V. and PLATONOV, M. N., Moscow Scientific-Research Television Institute

[Abstract] The block diagram and operating principles of a light-emitting diode matrix flat screen are considered. Included in the diagram are: 1) An analog-to-digital converter; 2) Programmed constant storage; 3) Series-parallel register; 4) Parallel register; 5) Current generator; 6) Generator of gradiation pulses; and 7) Generator of clock frequency. In order to check the devices experimentally a model was prepared with a flat matrix screen with 64 x 64 elements and a spacing between elements of 600 microns, composed of four experimental models of a screen with a red color glow ($\lambda \simeq 665$ nm) with the number of elements 32 x 32 each. The matrix of the light-emitting diode 32 x 32 was produced according to planar-epitaxial technology on the basis of a special epitaxial structure of arsenide-phosphie of gallium. The area of the radiating element (light-amitting diode) is $4 \cdot 10^{-4}$ cm^2. Figures 1.
[114-6415]

UDC 681.3.058

DEPENDENCE OF EQUALIZATION PROCESS IN TRACKING ANALOG-TO-DIGITAL CONVERTER WITH NONUNIFORM LEVEL PROCESSING ON DISTRIBUTION OF QUANTIZATION LEVELS

Leningrad IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: PRIBOROSTROYENIYE in Russian Vol 26, No 11, Nov 83 (manuscript received 11 Mar 83) pp 31-35

SHEVCHENKO, V. P., Penza Polytechnic Institute

[Abstract] The algorithm of equalization by tracking in an analog-to-digital converter with nonuniform distribution of quantization levels is analyzed from the standpoint of high-speed processing of jump changes in the input signal. A procedure is developed for objectively estimating how the number of equalization strokes and thus also the processing speed depend on the distribution of quantization levels, also for determining the permissible deviation of those levels from the omptimum one. The bipolarity of the difference signal in the tracking mode of equalization and the consequent symmetry of equalization steps with respect to the "0" level are taken into consideration. Without loss of generality, the i-th quantization level P_i is assumed to be not higher than the i-th equalization step C_i but higher than $1/2C_i$. For simplicity, only the positive part of the scale of difference signals is considered in the analysis. Calculations on this basis yield $P_i = 3/4C_i$ as the optimum quantization level and $\sigma I_i = \frac{I}{2P_i} 100\%$ as the permissible relative deviation, or approximately $\pm 10\%$ and $\pm 30\%$, respectively, for even and odd quantization levels. The procedure can be easily formalized and extended to any distribution of quantization levels. The paper is recommended by the Chair (Kafedra) of Information-Measuring Techniques. Figures 2; tables 1; references: 2 Russian.
[87-2415]

UDC 621.314.25

TWO METHODS OF HIGH-SPEED PHASE-TO-CODE CONVERSION

Leningrad IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: PRIBOROSTROYENIYE in Russian Vol 26, No 11, Nov 83 (manuscript received 3 Nov 81) pp 35-38

MORDVOVA, V. I., SHTAREV, N. N. and SIVERTSEV, V. F., Tomsk Institute of Automatic Control Systems and Radioelectronics

[Abstract] Two methods are proposed for high-speed phase-to-code conversion of radio or video pulse signals, such a conversion including an intermediate resolution of the phase difference between signals into frequency-independent quadrature (sin-cos) components by means of two phase detectors and two phase shifters. The first method involves parallel interpolation of those quadrature components with their subsequent conversion to a voltage distribution $U = U_m \sin(m\psi - \varphi)$ uniquely related to the measured phase difference at the

multichannel interpolator output and then conversion of this voltage distribution to a U = 1/2[sign sin(mψ-φ)+1] one by means of comparators. The second method involves parallel-sequential and conveyor processing of several signals simultaneously at various stages, with hardware which includes logic circuits as well as sampling and storing device. The latter method increases the phase-to-code conversion speed to 200 ns only and the processable length of a binary code from 6 to 8 digits. The paper is recommended by the Chair (Kafedra) of Information-Measuring Techniques. Figures 2; references: 2 Russian.
[87-2415]

UDC 681.335

ESTIMATION OF SENSITIVITY THRESHOLD IN INTEGRATING ANALOG-TO-DIGITAL CONVERTERS WITH AVERAGING OF READINGS

Leningrad IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: PRIBOROSTROYENIYE in Russian Vol 26, No 11, Nov 83 (manuscript received 20 Dec 82) pp 48-50

FEDONIN, A. I. and ANDREYEV, A. B., Penza Polytechnic Institute

[Abstract] The minimum sensitivity threshold in integrating analog-to-digital converters with modulation of the input voltage and averaging of the output is characterized by the mean-square deviation of the output signal and thus determined by its dispersion. Estimation of this threshold takes into account its dependence on the duration T of an individual integration cycle and on the number n of averaged readings. The estimate is based on the noise characteristics of the operational amplifier, its noise consisting of a white component with spectral density S_0 and a flicker component coupled to the latter at some frequency f_0, as well as on the amplitude-frequency characteristic of the converter with zeros at multiples m/nT of the complete-integration-cycle frequency and with successive peaks of amplitudes decreasing in the ratio $0.64/(2m - 1)$ at frequencies $(2m - 1)/2T$. The paper is recommended by the Chair (Kafedra) of Information-Measuring Techniques. Figures 2; references: 2 Russian.
[87-2415]

UDC 681.2.08/53.08

INDUCTIVE TRANSDUCER FOR DISPLACEMENT-TO-FREQUENCY CONVERSION

Leningrad IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: PRIBOROSTROYENIYE in Russian Vol 26, No 11, Nov 83 (manuscript received 27 Jun 83) pp 66-69

SHAKURSKIY, V. K., Togliatti Polytechnic Institute

[Abstract] A controllable three-frequency oscillator, with two degrees of freedom, can be used as a displacement-frequency converter and as such is more accurate than a conventional LC-oscillator or two LC-oscillators with mixer. Controlling such an oscillator is possible by means of a nondifferential parametric displacement transducer whose inductance forms part of the tank circuit of a tunable first amplifier (frequency F_{10}), this amplifier successively followed by a mixer, a tuned second amplifier (frequency F_{20}), and another mixer whose output is connected directly back to the input of the first amplifier. The other inputs of both mixers are connected to and receive signals from a quartz oscillator (frequency F_3). Across the outputs of both amplifiers before a mixer, each is connected a difference-frequency discriminator. With the transducer inductance set within the middle of its range, the converter is adjusted so that $F_{10} + F_{20} \approx F_3$. When both amplifiers have sufficient gain to satisfy the condition of amplitude balance, then self-excited oscillations occur in the converter with frequencies F_1 at the output of the first amplifier and F_2 at the output of the second amplifier, $F_1 + F_2 = F_3$. A transducer which will ensure a frequency-displacement characteristic $F_{10}(o)$ such that $F_{10} = F_{20}F_1/(F_3 - F_1)$, where both frequencies F_1 and F_2 as well as their difference are linear functions of the displacement o, has been designed with a ferrite shell core carrying a coil in one cup and a cylindrical ferrite core for trimming in another cup. The transducer is connected into the tank circuit of the first (transistor) amplifier. The nonlinearity of its induttance-displacement characteristic can be varied during adjustment. Such a transducer extends the δ conversion range to at least $\delta = 5$ mm and reduces the nonlinearity error to 0.05%, with high temperature and time stability of the output frequency. The paper is recommended by the Chair (Kafedra) of the Theoretical Bases of Electrotechnology and Electronics. Figures 3; references: 4 Russian.
[87-2415]

UDC 621.391

DEFORMATION OF CORRELATION FUNCTIONS OF BINARY SEQUENCES BY ERRORS IN SYMBOLS OF ONE SEQUENCE

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 28, No 12, Dec 83 (manuscript received 9 Apr 82) pp 2386-2393

BESSARABOVA, A. A. and VENEDIKTOV, M. D.

[Abstract] In connection with correlation processing of complex video frequency signals after detection (element by element reception) this paper investigates deformation of periodic correlation functions and cross-correlation functions depending on the probability of errors (renaming) of binary symbols. Consideration is given to cases when, because of errors, the side overpeaks turn out to be a large central peak of the correlation function. Figures 4; tables 2; references 6: 5 Russian, 1 Western (in Russian translation).
[104-6415]

UDC 621.391.63

RECONSTRUCTION OF OPTICAL IMAGE FROM ITS AUTOCORRELATION

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 28, No 10, Oct 83 (manuscript received 25 Aug 81) pp 2023-2029

DEMIN, A. A.

[Abstract] Reconstruction of an autocorrelation optical image is considered as a problem of solving the integral equation $I(\rho\rho) = \int J(r)J(r - \rho\rho)dr$ with a kernel of the autocorrelation kind, $I(\rho)$ being the recorded image brightness distribution and $J(r)$ being a function of the radial coordinate proportional to the image brightness. A unique solution for each specific case is sought, while formally a generally infinite set of solutions exists. Usual constraints on $J(r)$ are that it be a non-negative finite function. An algorithm of search for the case where $I(\rho\rho)$ is a discrete function and the integral equation is reducible to a system of quadratic ones. The level of $J(r)$ discretization must be analogous to that of $I(\rho\rho)$ and thus equal to Δ^2, where area Δ^2 must be comparable with the resolution of the optical receiver. The gist of this algorithm is a solution tree and a scan for exclusion of all unsatisfying solutions. It yields two solutions representing the original image, they are inverted 180° relative to one another and thus constitute a unique solution for each specific case. The algorithm has been programmed for execution on a BESM-6 high-speed computer and is recommended for solution of problems which do not require processing in real time. Figures 3; tables 2; references 4: 2 Russian, 2 Western (1 in Russian translation). [84-2415]

UDC 621.373

ANALYSIS OF TRANSIENTS IN GENERATORS OF SINUSOIDAL OSCILLATIONS

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 28, No 12, Dec 83
(manuscript received 5 Oct 81) pp 2409-2413

RYBIN, Yu. K. and OSIPOV, A. V.

[Abstract] A previous paper by Rybin analyzes the nonlinear differential equations which describe the processes in generators of periodic oscillations, and determine the set of nonlinear functions with which oscillations in a stationary condition have a strictly sinusoidal form. On the basis of the equations obtained in this work, a synthesis is fulfilled for generators of sinusoidal oscillations. The present paper investigates the transients originating in such generators with the object of decreasing their duration. The investigation made of the behavior of the solutions of a differential equation with discontinuous nonlinear functions gives solutions, which with definite limitations on the nonlinear terms of the equation, make it possible to obtain sinusoidal oscillations with transients of short duration. After the feasibility is demonstrated of a generator according to this equation, sinusoidal oscillations with nonlinear distortions <0.1 % and a duration of transients <1 period are obtained. Figures 4; references: 2 Russian.
[104-6415]

UDC 621.384.326.2.084.2:681.326.74.06

SIMULATOR-PROBE FOR DIAGNOSTIC TESTING OF SHORT-WAVE RADIO CHANNELS

Yerevan PROMYSHLENNOST' ARMENII in Russian No 10, Oct 83 pp 20-22

GASPARYAN, Yu. M., MOVSESYAN, R. M., OGANESYAN, M. G., POLIYEVSKIY, G. A. and SHIRINYAN, P. A.

[Abstract] Introduction of new channel multiplexing equipment into short-wave radio channels within the framework of a Unified Automated Countrywide Communication System requires prior diagnostic testing of these radio channels, for which available probes simulating telegraph signals are not adequate. A special probe has been developed for this purpose which does not simulate the constant bias of a signal uncharacteristic of the new short-wave radio equipment but predistorts the discrete signal in conformance with the characteristics of channel multiplexing equipment, such equipment including narrow-band filters which ensure a normal distribution of pulsefront distortions and utilizing the multiray propagation effect which causes "swinging shift" distortion of the signal. The simulator-probe generates sequences of video pulses with ±20 V and +9 V amplitudes respectively, which constitute various combinations of "dots" with 1:1, 1:4, or 1:7 duty cycles, as well as pseudo-random pulse sequence with 100 baud or 200 baud manipulation rate. This probe can be used for estimating the corrective capability of a tested radio channel with regenerator, which is done by comparing the channel output signal with an analogous undistorted one and recording the number of errors in the case when the two signals differ. The probe can also be used for channel inspection with a ring-type phase indicator. The probe includes a pulse generator with frequency stabilizing quartz crystal as master oscillator, its nominal pulse repetition rate of 2 MHz being reducible to 20 kHz by means of a D100 frequency divider. Its output signals are transmitted to two channels, one with and one without distortion, each containing identical subtracting and adding devices. A wobbling device connected through a switch simulates "swinging shift" of the regenerated signal. Added and subtracted pulses proceed from each channel to a D200 frequency divider, each of the two frequency dividers putting out a meander signal with 100 Hz repetition rate and 200 baud manipulation rate. Another frequency divider, with an adjustable quotient, serves as frequency corrector for the master oscillator. A counter-divider in each channel produces desired combinations of signals with 1:4 or 1:7 duty cycles. A pseudorandom signal is in each

channel produced by a shift register with feedback. A selector switch selects the desired kind of signal. Constant-bias and random-bias distortions are simulated by a rise-time and fall-time discriminator. Another switch directs the output pulses of this discriminator to a random-bias module, which also receives a randomly varying 4-digit binary code from a special noise generator, and to a similar constant-bias module with delay time control by means of a 5%-step switch. In the output stage of the probe the signal levels corresponding to logic "0" and "1" are converted to $\pm$20 V and $\pm$9 V respectively. Phase matching of the internal channel signal and the external predistorted signal is required before testing and is effected by means of a cycle phasing device. The ring-type indicator, built with an array of 20 light-emitting diodes, reads the phase after having been synchronized by 4 kHz (undistorted frequency) pulses. The entire probe is built with a high degree of circuit integration using series K155 microchips. Experimental operation of its first prototype has shown that it is a convenient and very reliable device. Figures 1; references: 2 Russian.
[93-2415]

UDC 621.395.22.029.7

PECULIARITIES IN CONSTRUCTION OF OPTICAL RECEIVERS FOR DIGITAL FIBER-OPTIC COMMUNICATION LINES

Leningrad IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: PRIBOROSTROYENIYE in Russian Vol 26, No 11, Nov 83 (manuscript received 28 Mar 83) pp 63-66

PIS'MEROV, O. B. and DEREVYANNYKH, I. M., Leningrad Institute of Electrical Engineering of Communication imeni Professor M. A. Bonch-Bruyevich

[Abstract] Optical receivers for fiber-optic communication lines in a radial network require booster amplifiers for signals which usually do not exceed 5 mV after preamplification. They are a.c. amplifiers with a clamped output level, automatic gain control, and a peak detector. This simple version is adequate for unidirectional lines with few branches. For staisfactory performance, their lower corner frequency should be far below the signal spectrum. If this is not possible, their output can be clamped to the zero level through an RC-circuit, regardless of the d.c. input level, and also for long intermission periods but with lowering of the response speed as a penalty. A booster amplifier for operation in a multistation with bi-directional lines, busbar structure, and time division of channels requires special features, specifically a high-speed peak detector which must be cleared after passage of the message carrying pulse packet. This is done by means of a precisely matched transistor pair able to generate a clearing pulse over a wide range of temperatures. For linear conversion (d/dt) of the preamplifier output signal it is expedient to replace the automatic gain control with a symmetric limiter-amplifier followed by a set of pulse rise time and pulse fall time discriminators in parallel, which respectively feed the R input and the S input of a trigger. The sensitivity and the dynamic range of such optical receivers befome somewhat worse as their complexity

increases. The paper is recommended by the Chair (Kafedra) of Signal Transmission and Theory of Nonlinear Electrical Circuits. Figures 3; tables 1; references 4: 1 Russian, 3 Western (1 in Russian translation).
[87-2415]

FEATURE - PRODUCTION EFFICIENCY

Yerevan PROMYSHLENNOST' ARMENII in Russian No 12, Dec 83 pp 17-20

GRIGORYAN, M. O., chief designer, OPTO [expansion unknown], Armpromsvyaz' [Armenian Industrial Communications]

[Abstract] This brochure praises the production and manner of operation of the Experimental Industrial-Technical Association "Armpromsvyaz." The unit produces more than a hundred forms of lead in - switching, television, telephone and radio-relay equipment. The high qulaity of its manufactured products, the stable reliability of its technical-operational characteristics, and its constructive and technological nature are well known, not only in the Armenian Republic but also beyond its borders. During the 11th Five-Year Plan, the enterprise was awarded the Diploma of the All-Union Central Trade-Union Council (VTsSPS) and the State Standard of the USSR "For Attainment of the Best Results in the Output of Production with the State Symbol of Quality." A complex solution of the problem of increasing the quality of manufactured articles and the growth of production efficiency lies at the basis of the united technical policy of the enterprise, which is obliged in 1985 to increase twofold the output of the equipment being produced. In the last 10 years, output of vacuum tube television amplifiers for systems of collective reception of telecommunications was set up at the enterprise. The requirements of this product are large, the technology of the flow is mastered, the workshops constantly overfill the plan assignments. However, the principle itself of tube amplifier operation is not promising because in the country production of new types of semiconductor devices evolves at a rapid rate. Consequently, not waiting until the product ethically becomes obsolete, the Department (Otdel) of the Chief Designer worked out a new specimen of a transistor band amplifier, which possesses a series of advantages in comparison with the output of articles for an analogous purpose. From the start-up of production, a considerable economic effect was attained: annually on this item the plant saves 50 tons of metal, and by and large in the country consumers save approximately 1 million kilowatt hours of electrical power on the transformers. The new product at onee went to the production level: output with sign of quality. During the years of the present Five-Year Plan, 115 measures for the technical and technological improvement of production were introduced, with an overall economic effect of 314.1 thousand rubles. An increase in the productivity of labor is discussed. Three photographs are shown of the activities of the plant. Figures 3.
[94-6415]

UDC 621.396.96:621.391.26

SYNTHESIS AND ANALYSIS OF EFFICIENCY OF SYSTEMS OF ADAPTIVE INTERPERIOD SIGNAL PROCESSING AGAINST BACKGROUND OF NOISE WITH UNKNOWN CORRELATION PROPERTIES

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 28, No 12, Dec 83 (manuscript received 25 May 81) pp 2373-2380

POPOV, D. I.

[Abstract] The paper investigates the principles of construction of adaptive processing systems, and methods of synthesis and analysis of the efficiency of systems with total adaptation to the correlation properties of noise. Widely-used systems for rejection of passive noise with subsequent coherent or noncoherent build-up of signals are studied. Synthesis of an optimum rejection filter (RF) based on a steady-state description of noise is considered, as well as the correlation matrices at the output of an adaptive RF. The effectiveness of a system of combined processing with adaptive RF of the second and third order is studied. Figures 6; tables 1; references 8: 6 Russian, 2 Western (1 in Russian translation).
[104-6415]

UDC 621.391:519.217.2

ASYMPTOTIC CHARACTERISTICS AND EFFICIENCY OF MULTICHANNEL SEQUENTIAL DETECTION OF SIGNALS

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 28, No 12, Dec 83 (manuscript received 6 May 82) pp 2394-2402

FISHMAN, M. M.

[Abstract] This paper is concerned with determination of the characteristics of multichannel sequential detection of signals, connecting the average duration of sequential procedures with the probability of incorrect solutions and the number of channels. Methods from a previous work by Fishman are used here for an analysis of multichannel sequential procedures in which acceptance of a solution takes place on the basis of the statistic "logarithm of ratio of probability", formed in each channel. It is assumed that these statistics are independent and conditions are fulfilled which make it possible to consider them (precisely or approximately) as homogeneous Markov processes with independent gaussian increments. References 10: 8 Russian, 2 Western (in Russian translation).
[104-6415]

UDC 621.391.161

ALGORITHM BASED ON MULTICHANNEL RECEIVER DATA FOR ESTIMATE OF NUMBER OF SIGNAL SOURCES

Kiev IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: RADIOELEKTRONIKA in Russian Vol 26, No 12, Dec 83 (manuscript received, after revision, 5 Jan 83) pp 12-16

KUZ'MIN, S. Z. and MEDVEDEV, V. P.

[Abstract] An algorithm is developed, based on a comparison of a reference signal with the received spatial distribution of signals at the output of a multichannel receiver where the received signal is normalized at the maximum value of the amplitude. This makes it possible to determine the number of signal sources $N = 1$ or $N > 1$ in cases where some signal sources are located in the limits of the major lobe of the directional pattern of a receiving antenna. Figures 4; references 4: 3 Russian, 1 Western.
[106-6415]

UDC 621.391.2

ADAPTIVE RANK SEQUENTIAL PROCEDURE OF DETECTION-ESTIMATION

Kiev IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: RADIOELEKTRONIKA in Russian Vol 26, No 12, Dec 83 (manuscript received 24 May 82) pp 16-21

AKIMOV, P. S. and LYSYY, V. M.

[Abstract] The paper considers: 1) An algorithm of detection-estimation; 2) Potential characteristics of detection; 3) Evaluation of adaptation parameters; and 4) Real characteristics of detection. The adaptive sequential procedure of detection-estimation considered, which stabilizes the probability of false alarm, assures effective and stable noncoherent detection of signals with various forms of distribution of the enveloping noise. Figures 2; references 12: 9 Russian, 3 Western (1 in Russian translation).
[106-6415]

UDC 621.391.36: 519.233.8

INVARIANT RECEPTION OF MULTIPOSITION INCOHERENT SIGNALS

Kiev IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: RADIOELEKTRONIKA in Russian
Vol 26, No 12, Dec 83 (manuscript received, after revision, 14 Apr 83)
pp 21-26

PUS', V. V.

[Abstract] The problem of classification of multiposition (multifrequency) incoherent signals in white Gaussian noise of unknown intensity is considered in three papers (1976, 77, 78) by V. N. Prokof'yev, where, on the basis of an invariance principle advanced in 1971 by the Western writers Ya. Gayek and Z. Shidak, several different criteria invariant to the scale of the watch are synthesized. The present paper studies this same problem and expressions are obtained for calculation of the power function of the invariant criterion of classification. Its effectiveness is evaluated with respect to an optimum noninvariant criterion for a known level of noise. The method presented for calculation of the characteristics of the invariant criterion of classification of multiposition signals is valid likewise and for calculation of the characteristics of multichannel systems, assuming the presence of a signal at the input of one of the channels. Tables 3; references 11: 5 Russian, 6 Western (2 in Russian translation).
[106-6415]

UDC 621.385.632

EFFECT OF ADDITIONAL SIGNAL ON STARTING GENERATION CURRENT OF BACKWARD WAVE WITH 'WEAK' INTERACTION OF SIGNALS

Kiev IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: RADIOELEKTRONIKA in Russian
Vol 26, No 12, Dec 83 (manuscript received, after revision, 27 Dec 82)
pp 31-35

TRIFONOV, A. I. and STARKOV, V. V. [deceased]

[Abstract] The paper obtains an analytical expression for the active component of the power of interaction of a specified two-frequency signal with an electron flow. One of the frequencies ω_{01} is assumed to correspond to the signal of a traveling-wave tube (TWT) and the other frequency ω_{02} to the signal of self-excitation of a backward wave in the TWT. From the expression found for the active component of the power of interaction, a formula is obtained for the starting current of the self-excitation. In order to obtain the formula, in which a quantitative evaluation can be obtained, it is necessary to allow for the exponential increase of the field and the space charge. The paper presents the results of certain computations with respect to the indicated formulas. The dependence of the starting current and the coefficient of desynchronism α_2, constructed with the use of the relations

obtained, qualitatively agrees with the results of an experimental investigation of the conditions of self-excitation in the TWT at the -1 harmonic of the backward wave. Recommendations are made with the object of increasing the stable operation conditions of a TWT. Figures 4; references: 6 Russian. [106-6415]

UDC 519.246.87

RANDOM SIGNAL RECOGNITION BASED ON SPECTRAL MOMENTS

Kiev IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: RADIOELEKTRONIKA in Russian
Vol 26, No 12, Dec 83 (manuscript received, after revision, 10 Jan 83)
pp 55-57

ATAYANTS, B. A. and PARSHIN, V. S.

[Abstract] This brief report notes that representation of signals in a frequency region makes it possible to minimize the description of the classes in question, to select highly-informative tests, and thus to increase the efficiency of recognition. Most frequently, during recognition of stationary noise signals, estimates of the spectral density of power are used as initial tests. These estimates are obtained at frequencies, multiples of K/N (N-number of readouts of the signal x(t) recognized; K = 0, 1, ... N/2) with the assistance of a discrete or rapid Fourier transform. An expression is derived which makes it possible in a first approximation to consider the statistically independent evaluation of the spectrum of frequencies, multiples of K/N. Evaluations of the probability of errors of recognition P_{osh} with various durations of the signals recognized are presented in a table. It follows from the table that during recognition of wide-band signals in separate spectral moments, P_{osh} is larger than during recognition with respect to evaluations of spectral density. However, as a rule during recognition of noise processes, realizations of sufficiently long duration ordinarily exist, which makes it possible to obtain acceptable R_{osh}. In addition, as calculations and modelling on an electronic computer showed, during recognition of narrow-band noise signals with spectral densities of the form $G(\omega) = \exp\{-\alpha(\omega-\omega_0)^2\}$, differing by the central frequency or the spectrum width, R_{osh} obtained with the aid of an algorithm drawn up, practically does not differ from P_{osh}, obtained with recognition corresponding to the first of second spectral moments. Tables 1; references 5: 4 Russian, 1 Western (in Russian translation).
[106-6415]

UDC 621.394.662

DOUBLE CORRELATION PROCESSING DURING SEARCH FOR PSEUDONOISE SIGNALS BY DELAY

Kiev IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: RADIOELEKTRONIKA in Russian Vol 26, No 12, Dec 83 (manuscript received, after further improvement, 18 Mar 83) pp 59-60

VOROB'YEV, A. S.

[Abstract] This paper consists of a detailed mathematical treatment of the above subject. It is shown that in correlative search the delay of pseudonoise signals usually establishes with respect to the main blip a reciprocal covariance function (VKØ1) of the incoming mixture of signal with noise and a copy of the signal, which is revealed by means of locating the maximum of this function, or by comparison of its value with the threshold level. In so doing, the signals tend to select the covariance function at a low level of the side blips, inasmuch as in combination with the noise component of the VKØ1 these blips can lead to an increased detection of the signals. However, the side blips as well as the main blip of the VKØ1 contain information concerning the synchroparameters of the signal, which it is possible to use as a supplementary by means of a secondary correlative processing of the signal. The essence of it involves calculation of a secondary reciprocal covariance function VKØ2, a covariance function copy of the signal and VKØ1. In so doing, delay of the signal is determined by the main peak of VKØ2. Single and double processing during coherent detection of the pseudonoise signals in white noise are compared. The main and side blips of the VKØ1 constitute the random magnitudes x_0 and x_1, respectively, distributed according to a normal law with dispersion $\sigma^2 = 2E/N_0$, where E is the energy of the signal, and N_0 is the spatial density of the noise power. In so doing, the mathematical expectation of the main blip VKØ1 is $r_0 = 2E/N_0$ and the side blips are designated by means of r_i (i = 1,2,..., n), where n is the number of readings off of the side blips VKØ1. It is obvious that the values of VKØ2 during the action of white noise are also magnitudes distributed according to a normal law. It is assumed that the solution during detection of a signal with single and double correlative processing begins by a comparison of the values of VKØ1 and VKØ2 with some threshold values of other units. As the result of the modelling conducted of the double correlative processing 1023-x of an elementary segment of a Khoffmen sequence, which is characterized by an irreducible primative polynomial $p_1(x) = x^{13} + x^{12} + x^{10} + x^9 + 1$ and a single processing of the 1023-x elementary Khoffmen sequence which is characterized by a polynomial $p_2(x) = x^{10} + x^3 + 1$, a gain with respect to energetics amounting to 3.4 db is determined. References: 3 Russian. [106-6415]

UDC 621.391.14:519.2

EXPERIMENTAL INVESTIGATION OF ALGORITHMS OF SIGNAL CLASSIFICATION IN SPECTRUM DOMAIN

Kiev IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: RADIOELEKTRONIKA in Russian Vol 26, No 12, Dec 83 (manuscript received, after revision, 4 Jan 83) pp 69-71

DANIYEV, Yu. F. and RYZHOV, V. P.

[Abstract] In solving the problem of classification (identification of signals, of signals, more and more consideration is given to spectral signs, which are connected with the possibilities for a simple reduction of description, with a greater performance in terms of error probability of classification and the advantage of realization of corresponding algorithms on a digital computer. Together with that, a number of practically important questions of the choice of the basis of resolution, evaluation of the effectiveness of various procedures for contraction of description, etc., are not solved in the theory of signal classification. In this brief report these problems are solved by themodeling on a BESM-6 digital computer of algorithms of signal classification. With various basic expansions and different methods of reducing descriptions. A number of conclusions are furnished with respect to the most advisable procedures. Figures 4; tables 2; references: 5 Russian. [106-6415]

COMMENTS AND ADDITION TO PAPER BY V. I. VINOKUROV AND YU. N. OVCHAROV: 'ALGORITHMS OF INCOHERENT DETECTION OF A SIGNAL ON A BACKGROUND OF NOISE WITH UNKNOWN INTENSITY'

Kiev IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: RADIOELEKTRONIKA in Russian Vol 26, No 12, Dec 83 (manuscript received 10 Jun 81) pp 83-84

VASIL'YEV, K. K.

[Abstract] In his letter to the editor, K. K. Vasil'yev disagrees with the first part of a paper by V. I. Vinokurov and Yu. N. Ovcharov [1] which contains an analysis of the effectiveness of two detectors of noncoherent signals. These are based on a logarithmic transform of a post-detector random process. Vasil'yev states than in this connection "a preference is established for them in comparison with a known, locally most powerful (LMP) detection algorithm with a small amount of noise sampling." Undoubtedly, he writes, a situation appeared in which nonoptimum principles of detection proved effectively to be the most powerful. The error of the authors of [1] lies in teh fact that their algorithm $\Lambda = \sum_{j=1}^{n} \lambda_j \gtrless C$ is not a LMD and is not proposed in the works to which references are given. The noiseproof features of this algorithm are compared with LMP (with $q \to o$) and according to

Vasil'yev the LMP principle is substantially more effective. Vasil'yev now turns to an "addition" to [1], the second part of which is devoted to a comparative analysis of the digital analogs of the algorithms Λ, L and $\emptyset$ under consideration. According to Vasil'yev, in so doing the digital analog Λ is selected, not entirely successfully, from the point of view of distribution of the quantization levels, as well as the possiblity of its technical realization. Another digital analog $\tilde{\Lambda}_0$ is considered better. Vasil'yev concludes that the algorithms of work [1] play over known procedures with respect to the magnitude of the threshold signals, but have a simpler technical realization at the cost of elimination of the antilogarithmic operation. References 3: 1 Russian, 2 Western.
[106-6415]

RESPONSE OF AUTHORS TO LETTER TO EDITOR BY K. K. VASIL'YEV: 'COMMENTS AND ADDITION TO PAPER BY V. I. VINOKUROV AND YU. N. OVCHAROV: ALGORITHMS OF INCOHERENT DETECTION OF A SIGNAL ON A BACKGROUND OF NOISE WITH UNKNOWN INTENSITY'

Kiev IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: RADIOELEKTRONIKA in Russian
Vol 26, No 12, Dec 83 pp 84-85

VINOKUROV, V. I. and OVCHAROV, Yu. N.

[Abstract] The authors agree that consideration of the algorithm $\tilde{\Lambda}_0$ put forward in the letter of K. Vasil'yev can arose interest. Let us note only that he did not examine it in view of the obvious complexity of the operation of taking antilogarithms (antilogarithmic operation). See, for example, references (4), (5) in our paper, and the additional loss introduced into it. As is evident from the formula for ℓ_i in K. Vasil'yev's letter, the losses of $\tilde{\Lambda}_0$ in comparison with Λ exceed the losses of algorithms (9) - (11) (in [1] of the paper by paper by V. I. Vinokurov and Yu. N. Ovcharov), and in comparison with his analog prototype turns out to be considerably simpler. Thus the authors consider that the investigations conducted in work [1] of algorithms of incoherent detection of signals with unknown noise power are correct. References: 6 Russian.
[106-6415]

UDC 621.382.002(088.8)

MANUFACTURE OF SEMICONDUCTOR CAPACITORS WITH GIVEN FUNCTIONAL DEPENDENCE ON APPLIED VOLTAGE

Kiev IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: RADIOELEKTRONIKA in Russian Vol 26, No 12, Dec 83 (manuscript received 16 Jul 82) pp 46-47

SAFRONOV, V. V.

[Abstract] A farther enlargement of capacitor types with functional dependence of the capacitance on the applied voltage is possible with the aid of a method described in this brief report, which makes it possible to control the nature of the distribution of an admixture and its concentration with respect to the depth of the monocrystal, the thickness of which is considerably less than the screening thickness of an oxide silicon film, applicable in the case of masking the surface of the monocrystal. In the case of diffusion p-n junctions produced by the method described and used as capacitors with a functional dependence of the capacitance on the applied voltage, the following parameters are found to be typical: breakdown voltage up to 70 volt, spread of nominal face value 10÷30%; specific capacitance up to 2500 pf/mm^2; temperature coefficient of resistance, approximately 200. $10^{-6}(K°)^{-1}$. Figures 1.
[106-6415]

UDC 621.396.6.519.1.001.2

DETERMINATION OF LAYOUT INTERACTIONS BETWEEN COMPONENTS OF RADIOELECTRONIC ITEMS

Kiev IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: RADIOELEKTRONIKA in Russian Vol 26, No 12, Dec 83 (manuscript received, after revision, 20 Dec 82) pp 66-68

BOGDANOV, G. M.

[Abstract] All functional component parts of an item E_I interact with respect to functional connections: thermal, electrical, magnetic and electromagnetic compatability, as concerned with mass and others. The

center (core) E_{IO} of the item's composition always stands out. The best way with respect to a technical assignment is to place all the remaining E_I around the center. It is necessary to recognize the interaction of all E_I; in all forms of existing connections in an item, firstly for determination of the order of implication of E_I in the multistep process of search for the best variation with respect to a technical assignment of E_I, and secondarily for a choice of the best variation of the placement of E_I at each step. This brief report is concerned with determination of the layout interaction (LI) between the components of items which is dependence in magnitude and direction on the construction and the physical nature of the processes proceeding in the components and on the interplacement of these components. The coordinates of LI have diverse natures (functional, thermal, electrical, mechanical and others) and, consequently, the magnitude of LI can only be described by a qualitative relation to each coordinate, from which it is necessary to obtain the resultant evaluation of a complete LI between each pair of E_I. In so doing, for each E_I with respect to all coordinates of LI, the constructor must obtain answers to a number of questions discussed in this report. Figures 2; tables 1; references 3: 1 Russian, 2 Western (1 in Russian translation).
[106-6415]

UDC 539.216.2:535.24

PHOTOELECTRIC MONITORING OF DEPENDENCE OF ELECTROPHYSICAL PARAMETERS OF SEMICONDUCTOR STRUCTURES ON THEIR OPERATING CONDITIONS

Kiev IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: RADIOELEKTRONIKA in Russian Vol 26, No 12, Dec 83 (manuscript received, after revision, 10 Jan 83) pp 72-73

MOSHKIN, V. I. and KHARSHILADZE, N. Sh.

[Abstract] This brief report describes monitoring of the condition of dependence of the electrophysical parameters of $p^+ - i(p)-n^+$ structures, which is accomplished by a photoelectric method for the results of measurements of the spectral dependence of the photoresponse. Measurements were made of devices by an installation, the circuit and description of which are given. In the installation a modulated monochromatic flow of radiation is formed with an intensity ϕ_o which acts on the structure of the devices in question. The curves shown in the report for various values of hV make it possible to judge concerning the nature of the distribution of the levels of injection and the intensity of the electrical field with respect to the thickness of the base of the $p^+-i(p)-n^+$ structure. Figures 3; references: 2 Russian.
[106-6415]

UDC 681.32

EVALUATION OF TRIGONOMETRIC FUNCTIONS ON 'ELEKTRONIKA BZ-34' MICROCALCULATOR

Leningrad IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: PRIBOROSTROYENIYE in Russian Vol 26, No 11, Nov 83 (manuscript received 21 Dec 81) pp 44-47

SMOLITSKIY, Kh. L., Leningrad

[Abstract] Three algorithms are proposed for evaluating trigonometric functions of argument x in the decimal system with not more than 8 significant figures on an "Elektronika BZ-34" microcalculator, and they are analyzed for accuracy, assuming that the microcalculator has 9 digits available for the mantissa. The first algorithm yields $n = \text{entier}(0.5 + x/P_1)$, where $n = a_1 \cdot 10^{\nu-1} + \ldots a_{\nu-1} \cdot 10 + a_\nu$ and P_1 is carried into the read-only memory. The second algorithm yields successively $n' = x/P_1$, $n'' = 0.5 - n\gamma/P_1$, $n = \text{entier}(n' + n'')$, ε_1 in a ν-step process, and $\varepsilon_2' = (\varepsilon_1 - n/\gamma)_8$, with P_1 and $\gamma = P_2 - P_1$ carried into the read-only memory. The third algorithm yields what the second one does but also z_ν in a ν-step process and $\varepsilon_3' = z + n \cdot \delta$, with P_1, γ, and δ carried into read-only memory so that $P_3 = P_2 - \delta$. Here P_1, P_2, and P_3 are approximations of $1/2\pi$ with respectively 7, 15 and 23 figures after the decimal point. These algorithms are designed to reduce the otherwise large error which characterizes evaluation of trigonometric functions on this microcalculator. Tables 3.
[87-2415]

UDC 681.327.66(088.8)

HIGH-SPEED 16 KBIT BIPOLAR ON-LINE STORAGE MEMORY BASED ON INJECTION MEMORY ELEMENTS

Kiev IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: RADIOELEKTRONIKA in Russian Vol 26, No 12, Dec 83 (manuscript received, after completion, 18 Apr 83) pp 7-12

BARINOV, V. V. and KOVALDIN, D. Ye.

[Abstract] The paper describes a new 4-transistor injection storage element, in which diodes are used (in mono- and polycrystalline silicon or Schottky

diodes) for an increase of the read-out signal and an improvement of the noise immunity. A new circuitry solution was developed. This problem as well as the problem of expansion of the temperature range of the on-line storage (OLS) to minus 60°C with conservation of the high speed of response and the low switching energy (less than 1 picojoule per bit) are successfully solved. Operation of the storage element, an analysis of the memory operation, and the principles of operation of a 16 Kbit OLS are considered. As the result of the work performed on the basis of the new injection storage element the circuit is projected on an OLS with a 16 Kbit information capacity, combined with integrated circuits of the TTL-type, efficient in the expanded temperature range and the power supply voltage (5 $\pm$ 0.5) volt. The time for selection with a temperature of + 25°C amounts to less than 40 ns with a power consumption of less than 500 milliwatt. It is possible to produce the circuit on a crystal with an area of approximately 20 mm^2 with a minimum topological dimension of 3 micrometer. Figures 3; tables 1; references 11: 6 Russian, 5 Western.
[106-6415]

UDC 518.3

ART OF PROGRAMMING FOR PROGRAMMABLE MICROCALCULATORS, PART 7: INTERPOLATION OF TABLE MODELS

Kiev IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: RADIOELEKTRONIKA in Russian Vol 26, No 12, Dec 83 (manuscript received 25 Apr 83) pp 40-45

TROKHIMENKO, Ya. K. and LYUBICH, F. D.

[Abstract] In connection with table model programmable microcalculators, the paper considers interpolation programs and algorithms of functional dependence according to Lagrange formulas with power polynomials. Program realization of the formulas is presented in six compact notations based on a 1983 paper by the authors: 1) Program 1/34. Interpolation by Lagrange formula of tabular models for $n + 1 \leq 10$ unequally spaced units; 2) Program 2/34. Calculation of coefficient b_i of interpolating Newton polynomial, coefficients a_i and a_i of interpolating of power polynomial with initial and shifted origin of reading of argument and result of interpolation of $y(x)$ with respect to tabular model with $n + 1 \leq 6$ unequally spaced units; 3) Program 3/34. Tabular models interpolated according to the Lagrange formula with arbitrary number $n + 1$ of equally spaced units; 4) Program 4/34. Calculation of coefficients a_i of interpolating Newton polynomial, coefficients a_i and values $A(z)$ of power polynomial with $z_o = 0$ and $n + 1 \leq 10$ equally spaced units; 5) Program 5/34. Calculation of the coefficient σ_i for interpolation of tabular model with six units; and 6) Program 6/34. Calculation with respect to values of coefficients. References: 6 Russian.
[106-6415]

UDC 621.385.632.2

INTERRELATION BETWEEN PARAMETERS OF M-TYPE TRAVELING-WAVE TUBE

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 28, No 10, Oct 83
(manuscript received 24 May 82) pp 1986-1992

IVOYLOV, V. F. and CHERNYSHEV, A. S.

[Abstract] Interrelations between the main performance parameters of an M-type traveling-wave tube are established on the basis of fundamental relations in the theory of such devices. To be specific, the most common device with a long Caino gun forming a laminar electron beam and with a "rectangular helix" or "meander" retarding system is considered. Expressions are derived describing the efficiency and the output power as functions of the supply voltage, both being largely limited by the maximum allowable electron beam thickness and by the condition of synchronism. Accordingly, an interrelation between maximum efficiency and maximum output power is established, under each of these limiting constraints. An interrelation is also established between efficiency and bandwidth under the constraint of maximum allowable asynchronism between a high-frequency field and an electron beam. These relations indicate that raising the efficiency, for optimum performance of the output amplifier, is only possible by decreasing the bandwidth and the output power. The analytical expression fit, within 30%, catalog data on existing devices such as the RW-617/618/619/61B traveling-wave tubes. Figures 2; tables 3; references 8: 7 Russian, 1 Western (in Russian translation).
[84-2415]

UDC 621.385.64

SIGNAL FLUCTUATIONS IN DEMATRON

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 28, No 10, Oct 83
(manuscript received 2 Oct 81) pp 1993-2000

GRISHIN, V. I.

[Abstract] Signal fluctuations in an amplifier with an open electron beam are analyzed and evaluated on the basis of the fundamental equation describing

the charge buildup in such a device. Averaging this equation over the interval of retarding phases, with the drift velocity of the electron beam in crossed static fields taken into account, transforms this equation to an analog of the Fokker-Planck equation for the probability density of $I_{0i} \rightarrow I_i$ transition. A simple approximate solution for the mathematical expectation and the dispersion of the beam current yields analytical expressions for fluctuations of the secondary-emission current and of the rise time and the amplitude of a high-frequency pulse. References 19: 12 Russian, 7 Western (4 in Russian translation).
[84-2415]

UDC 621.383.292

FREQUENCY CONVERSION IN PHOTOMULTIPLIER DURING INTERACTION OF PHOTOELECTRON BEAM AND ELECTRIC FIELD IN HETERODYNE

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 28, No 10, Oct 83 (manuscript received 14 May 82) pp 2047-2051

DIANOVA, V. A., MUSTEL', Ye. R., PARYGIN, V. N. and BEZRUCHENKO, V. I.

[Abstract] The problem of frequency conversion in a photomultiplier with a grid is solved on the basis of interaction between photoelectrons and the electric field in the heterodyne. The solution covers a wide range of electron transit angles and applies to an arbitrary heterodyne signal. Two processes which follow formation of a photoelectron beam by modulated optical radiation are taken into consideration, namely electron bunching and current cutoff. Calculations in a single-velocity approximation, the velocity corresponding to the constant voltage $V_0 = m_e v_0^2/2e$, yield the difference-frequency component of the convection current and a transcendental equation relating the time of electron entrance into the photocathode-grid space and the time of electron transit from photocathode to grid. These relations determine the dependence of that difference-frequency current in the first dynode stage on the heterodyne voltage. The quiescent transit angle, the frequency deviation, and the ratio of heterodyne voltage to constant voltage are parameters in this relation. The results reveal that at low electron transit angles in a photomultiplier with an auxiliary grid, the dominant process is current cutoff. They also indicate that the optimum heterodyne voltage increases at first and then remains the same as the electron transit angle increases. Figures 6; references: 4 Russian.
[84-2415]

UDC 621.382.233.011.222.072.1

HIGH-SPEED THYRISTORS ON WEAKLY DOPED GaAs

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 28, No 10, Oct 83 (manuscript received 1 Dec 81) pp 2052-2056

GAYBULLAYEV, S., GAPPOYEV, A. B., DANIL'CHENKO, V. G., KOROL'KOV, V. I., NIKITIN, V. G. and POZHKOV, A. V.

[Abstract] An earlier study of GaAs thyristors with a thick weakly-doped n^o-base layer (W_n/L_p 5) and a thin p-base layer (W_p/L_n 1) yielded their static characteristics and the distribution of excess charge carriers in the n^o-base, this distribution indicating a strong effect of intrinsic recombination radiation on modulation of the conductivity of that n^o-base region in the ON state. A subsequent experimental study was made for the purpose of explaining this anomaly of such four-layer structures on wideband materials. Specimens were produced by standard technology in a graphite crucible, which included growing a p-$Al_xGa_{1-x}As$ (x = 0.10-0.15) emitter and doping it with germanium ($p^+ = 10^{18}$ cm^{-3}). Current-voltage characteristics were measured, revealing a low residual voltage hardly dependent on the n^o-base thickness and on the turn-off current. Control voltage-current characteristics were measured, revealing that the switch-over voltage remains constant over the 0-20 A/cm^2 range and decreases linearly over the 20-50 A/cm^2 range of the control current. Other measurements included dependence of the effective length of the diffusion path for excess charge carriers on the current density in p-type and n-type weakly-doped GaAs specimens, dependence of the current buildup time on the anode voltage at a typical control current of 200 A/cm^2, and dependence of the turn-off time on the current density. The results indicate the feasibility of producing GaAs thyristors for switching voltages up to 2 kV and commuting currents of 15 A in 15-20 ns, by reducing the impurity concentration and increasing the thickness of both base layers. The authors thank Zh. I. Alferov for interest and attention. Figures 6; references 7: 5 Russian, 2 Western.
[84-2415]

UDC 681.177

IMAGE IDENTIFICATION BY METHOD OF INTEGRAL FLUCTUATIONS

Leningrad IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: PRIBOROSTROYENIYE in Russian Vol 26, No 11, Nov 83 (manuscript received 28 Apr 82) pp 70-74

GORODETSKIY, A. Ye., KUZ'MIN, P. P. and TARASOVA, I. L., Leningrad Institute of Precision Mechanics and Optics

[Abstract] Harmonic analysis of integral fluctuations is considered as a method of image identification more economical, in terms of computer time and capacity, than the method of boundary inequalities and the correlational

method in the case of a very large number of images. For analyzing the integral fluctuations of image intersections, an identifiable image with contour $\lambda(x)$ is multiplied n times by an information carrier with a period H and n times by an information carrier with a period h so as to form functions $\psi(x) = \sum_{i=0}^{n} \lambda(x + iH)$, $\varphi(x) = \sum_{i=0}^{n} \lambda(x + ih)$ where $\sum_{i=0}^{n} x_2 - x_1 < h < H$, $h/H = p/q$ is an irreducible fraction and $|H - h| < H,h$. The optimum resolving procedure consists of harmonic analysis of U $U(Q) = \int_0^{\tau} \psi(x) \bigcap_{\min} \varphi(x + Q)dx$ $(T = pH = qh)$ and comparing each harmonic component with a reference. The equipment for implementing this procedure includes a projection screen, a readout device with an objective, a memory, and two multipliers. Each multiplier records the image on a moving information-carrier tape, one moving at velocity V_1 where the image is recorded 2N times (N>p) with period H, and one moving at velocity $V_2 \neq V$ where the image is recorded 2n times with a period h<H. Both tapes are played back while moving parallel to one another under uniform illumination from a lamp through an objective. A photoreceiver measures, through another objective, the amount of light passing through the carrier tapes, this amount being proportional to the image intersection area. The photoreceiver feeds data to a power spectrum analyzer. The latter calculates the constant component and the alternating component of the signal power spectrum, then transmits their values to a comparator where they are compared with those of the reference spectrum. The method has been found to be fast and reliable, requiring only one shift of an image. There is no universal optimum resolving procedure, however, but one for any specific identification problem and image class. The paper is recommended by the Chair (Kafedra) of Optical-Electronic Devices. Figures 1; references 5: 3 Russian, 2 Western (both in Russian translation).
[87-2415]

UDC 537.533.2

PRESENT STATE AND SOME WAYS FOR FURTHER DEVELOPMENT OF AUTOELECTRONIC EMISSION (REVIEW)

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 28, No 12, Dec 83 (manuscript received 12 Feb 82) pp 2305-2312

BONDARENKO, B. V.

[Abstract] The history of the use of autoelectronic emission, the basic results of investigations concerning its practical use, the problem of stability of autoelectronic emission, certain new solutions, and promising directions for further investigations are summarized. The data presented obviously do not exhaust all of the diversity of research, and the theoretical and structural-technological solutions of both concrete and general problems of autoelectronic emission as a whole. However, they represent

both the level of programs already attained and the most promising problems of development of autocathodes and devices on their basis. References 29: 10 Russian, 14 Western (2 in Russian translation).
[104-6415]

UDC 537.312.62.029.6

JOSEPHSON POINT CONTACTS NOISE PROPERTIES AT MICROWAVE

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 28, No 12, Dec 83 (manuscript received 28 Apr 82) pp 2457-2459

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

[Abstract] The paper studies the noise of Josephson superconducting point contacts at a frequency of 8.6 Gigahertz. Choice of such a high frequency is explained, on the one hand, by the opportunity to enlarge the band of the intermediate-frequency amplifier to a magnitude $\Delta f \gg 1$ gigahertz, thereby increasing fluctuation sensitivity of the radiometer, and on the other hand, by the presence in the microwave band of sensitive amplifiers (masers, parametric amplifiers). A block diagram of the experimental unit is shown and its operation is explained in detail. With voltages at the contact close to the voltage corresponding to observation frequency, the characteristic Josephson generation of the contact gives the main contribution to the noise. With $U>1$ mV, the fluctuations increase with an enlargement of the voltage at the contact. With contacts which possess the high values $U_0>0.5$ mV and $r\gtrsim 5$, a complex structure is observed of the noise maximums, corresponding to the voltage of the energy gap of the niobium and its subharmonics. With incomplete coordination of the contact with the intermediate frequency channel, the total power of the noise incoming from the contact to the amplifier can substantially exceed the intrinsic noise of the superconducting point contacts. This occurs because of reflection by the contact of noise arriving at it from the direction of the amplifier. The excess can be extremely substantial with the use of noncooled amplifiers or cooled amplifiers, the radiation of which from the input side exceeds the thermal. This is correct for various types of cooled mixers and is still more significant for superconductor--insulator--superconductor mixers, becuase their noise temperature is lower. In order to eliminate additional reflected noise in real mixers where it is not always possible to attain complete agreement of the nonlinear element with the channel and the conditions of agreement vary with a change of the working point and the heterodyne power, it is necessary to employ cooled rectifiers. Figures 2; references 6: 3 Russian, 3 Japanese.
[104-6415]

UDC 621.373.5

UTILIZATION OF NONLINEAR PROPERTIES OF IMPATT-DIODES IN MICROWAVE DEVICES (SURVEY)

Kiev IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: RADIOELEKTRONIKA in Russian Vol 26, No 10, Oct 83 (manuscript received 3 May 83) pp 4-18

D'YACHENKO, S. M., ZINCHENKO, S. A., KOTSERZHINSKIY, B. A. and TARANENKO, V. P.

[Abstract] Applications for IMPATT diodes with utilization of their nonlinear properties in microwave devices are reviewed from the standpoint of design and performance. The three major applications are harmonic oscillators, frequency multipliers and frequency converters. Power and frequency ratings of those devices using IMPATT diodes as well as particular characteristics such as conversion efficiency, bandwidth, i-f power and d.c. power, based on Soviet and foreign manufacturers' data, are compared with those of corresponding devices on Gunn-effect or Schottky-barrier diodes. The survey indicates that microwave devices with IMPATT diodes have the highest efficiency, such devices being the principal available power sources at frequencies above 200 GHz, and that a waveguide construction of microwave devices is the preferable one. The performance of harmonic oscillators with IMPATT diodes can be optimized by selecting the electron transit frequency equal to the output harmonic frequency and adding a tunable idle fundamental-frequency resonator, the stability of harmonic oscillations being raised by synchronization of the fundamental-frequency oscillations. Frequency multiplication requires high-power low-noise IMPATT diodes with high stability, as a replacement for varactors, with a nonresonant capacitive load for ensuring high conversion efficiency. Figures 5; tables 4; references 64: 18 Russian, 46 Western.
[85-2415]

UDC 537.312.62

SUPERCONDUCTIVE FILMS IN MICROWAVE MICROELECTRONICS (SURVEY)

Kiev IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: RADIOELEKTRONIKA in Russian
Vol 26, No 10, Oct 83 (manuscript received 3 May 83) pp 18-28

VENDIK, O. G. and KOZYREV, A. B.

[Abstract] Applications for superconductive films in microwave microelectronics are reviewed from the standpoint of feasibility and performance. The three major applications are passive elements, control elements, and active elements. Superconductive passive elements under consideration are microstrip lines, which utilize the surface resistance of superconductors and whose feasibility is determined by the magnitude of this resistance. Superconductive control elements utilize the inductance of superconductors for frequency control through phase velocity oruutilize the abrupt change in surface impedance upon transition from superconducting to normal state for amplitude control by attenuation, limiting, or cutout. Superconductive active elements include detectors and mixers which operate either with the single-particle tunneling effect or with the Josephson effect during paired tunneling. Figures 13; references 56: 21 Russian, 35 Western.
[85-2415]

UDC 621.391.832.4

INTERMODULATION DISTORTIONS IN SEMICONDUCTOR MICROWAVE RECEIVERS AND TRANSMITTERS (SURVEY)

Kiev IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: RADIOELEKTRONIKA in Russian
Vol 26, No 10, Oct 83 (manuscript received 7 May 82) pp 28-38

KHOTUNTSEV, Yu. L.

[Abstract] Signal distortion by intermodulation in semiconductor microwave receivers and transmitters is reviewed from the standpoint of its analysis and suppression. Description of a nonlinear current-voltage characteristic by polynomials and analysis of the interaction between signal voltage and device nonlinearity on this basis reveal harmonic and difference-frequency components of intermodulation. In addition to the basic Volterra-Wiener method with supplemental stability analysis for also covering subharmonics as well as hysteresis and memory effects, also other methods such as the harmonic-balance method, the nonlinear-current method, and recurrence relations have been used for determining the intermodulation components in receiver and transmitter amplifiers, mixers, and frequency converters. Amplifiers using bipolar transistor or field-effect transistors with Schottky barrier and amplifiers using IMPATT diodes or Gunn-effect diodes have been analyzed for intermodulation distortion. Known circuital methods of intermodulation suppression include operating along the least nonlinear

ranges of device characteristics or with special-purpose devices such as field-effect transistors with an exponential channel doping profile and lowering the oscillation amplitude, matching the impedances at parasitic frequencies with those at operating frequency, and compensating by predistortion, feedback, automatic control, or addition or "feed forward" amplifiers. Figures 8; references 58: 9 Russian, 49 Western.
[85-2415]

UDC 621.372.852

APPROXIMATION MODELS FOR ELECTRODYNAMIC SYSTEMS IN SOLID-STATE MILLIMETRIC-WAVE DEVICES

Kiev IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: RADIOELEKTRONIKA in Russian Vol 26, No 10, Oct 83 (manuscript received 6 Apr 83) pp 38-45

KOTSERZHINSKIY, B. A.

[Abstract] Design and performance calculations for solid-state millimetric-wave devices are generally based on mathematical models, especially crucial being those which describe the electrodynamic system. The unwieldiness of exact models in both form and content, with special functions and infinite series in systems of many equations, has made it necessary to develop simpler approximate models without loss of adequacy. Typical such models are those for describing waveguide-and-pin structures, with algorithms constructed and programmed for computer-aided verification of their accuracy and adequacy. The simplest model of such an electrodynamic structure is a short-circuited segment of a rectangular waveguide and a thin metal pin inside with clearance for accommodating the active element. Calculation of the input impedance becomes more difficult as the pin thickness increases and the electric field in the gap ceases to be uniform so that further approximation is required. The concept of equivalent T-networks has been found to be satisfactory and was extended to electrodynamic structures containing one pin with two gaps and those containing two symmetric pins with identical gaps or two pins with asymmetric identical gaps. In addition, a four-arm model is used for waveguide-coaxial structures and a heuristic "thick pin" model is used for coaxial-waveguide structures. Figures 6; tables 5; references 16: 9 Russian, 7 Western.
[85-2415]

UDC 621.372.632

MILLIMETRIC-WAVE FREQUENCY CONVERTER USING GUNN-EFFECT DIODE

Kiev IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: RADIOELEKTRONIKA in Russian
Vol 26, No 10, Oct 83 (manuscript received 16 Mar 83) pp 45-51

RADCHENKO, A. F. and MALYSHEV, I. V.

[Abstract] The frequency conversion characteristics of Gunn-effect diodes operating in the negative-conductance mode in the millimetric-wave range are calculated in the small-signal approximation on the basis of two phenomenological equations, one for the mean energy of random electron motion and one for the mean electron drift velocity. The mixer is represented by an equivalent circuit, assuming a uniform frequency characteristic and a nearly linear phase characteristic of the active diode element with its pass bands limited by ideal filters. An experimental study was made, its results confirming the results of theoretical analysis. A microwave oscillator with a Gunn-effect diode was used as the heterodyne, with the frequency varied from 26 to 38 GHz and the power regulated by means of an attenuator before being transmitted through a ferrite diode, a circulator, and a waveguide switch to the mixer. A standard oscillator with calibrated output served as the source of signal power and the latter was transmitted to the mixaer through a calibrating attenuator and a directional coupler. Diodes with high doping level and diodes with low doping level were found to behave differently, in terms of the conversion efficiency as a function of the heterodyne power, the maximum conversion efficiency being higher and occurring at a lower heterodyne power in the latter case. Figures 6; references 14: 10 Russian, 4 Western (1 in Russian translation).
[85-2415]

UDC 621.373.027.9:621.3.029.64

DESIGN OF LOCKED MICROWAVE OSCILLATORS ON BASIS OF SCATTERING PARAMETERS OF TRANSISTORS OPERATING IN LARGE-SIGNAL MODE

Kiev IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: RADIOELEKTRONIKA in Russian
Vol 26, No 10, Oct 83 (manuscript received 4 Feb 83) pp 51-55

PETROV, G.V. and KHRAMOV, A. V.

[Abstract] A method of designing microwave oscillators with external locking is proposed which utilizes not the admittance Y-parameters but the scattering S-parameters of a transistor operating in the large-signal mode. It is based on using an active element with a strong internal feedback, such as a KT640 transistor, assuming that only the $|S_{21}|$ parameter depends on the transistor input power and assuming a sufficiently narrow locking band so that the frequency dependence of the S-parameters can be disregarded. The performance

of such an oscillator is calculated on this basis, an oscillator with a lossless output matching L-network being considered as a specific example. The results indicate that this method is reliable for transistors operating within a range of small nonlinearity. It can be extended to oscillators with external feedback, but then the frequency dependence of the S-parameters must be taken into account. Figures 4; references 8: 4 Russian, 4 Western. [85-2415]

UDC 621.382.012.001.4:311.16

CORRELATIONAL ESTIMATION OF PARAMETERS OF SOLID-STATE MICROWAVE DEVICES

Kiev IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: RADIOELEKTRONIKA in Russian Vol 26, No 10, Oct 83 (manuscript received 9 Mar 83) pp 55-59

LEBEDEV, I. V., SHNITNIKOV, A. S. and SOLODOV, Yu. S.

[Abstract] A method is proposed for determining the true variance of parameters of a solid-state microwave device under unfavorable conditions of quality control. This information is needed in development, production, and application of the device, not only because it reveals deficiencies in the design model and in the technological process but also because it is often buried by the complexity of the test equipment and submerged in the sometimes even larger measurement error. The method of estimating the manufacturing variance is a statistical one, a given parameter which characterizes a product lot being sought in the form of a useful signal submerged in interference from all possible distorting factors. Signal and interference are each assumed to be independent random processes, and the resultant dispersion of actual readings is treated as a superposition of both. The standard deviation is determined, accordingly, with use of the correlation coefficient and the confidence range of the latter as well as the adequacy of the sample size are checked against the "3σ" criterion. Figures 1; references: 8 Russian.
[85-2415]

UDC 518.5

ART OF PROGRAMMING PROGRAMMABLE MICROCALCULATORS, PART 5: FORMING PROBLEM CONTROL LANGUAGES

Kiev IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: RADIOELEKTRONIKA in Russian Vol 26, No 10, Oct 83 (manuscript received 6 Apr 83) pp 69-74

TROKHIMENKO, Ya. K. and LYUBICH, F. D.

[Abstract] Formation of high-level or problem control languages in a programmable microcomputer, including program identifiers and input language operators, is demonstrated on software for evaluation of hyperbolic and inverse hyperbolic functions. The programs are 1/21, 2/21, 3/4 (calculate sinh x, cosh x, tanh x, $\sinh^{-1}x$, $\cosh^{-1}s$, $\tanh^{-1}x$) and 4/34, 5/21 (operate on complex numbers). These programs have been designed for mass-market microcomputers operating with small direct-access memory and without peripheral equipment so that only data input in digital or command form is possible.
References: 3 Russian.
[85-2415]

UDC 621.373.5

MODULATION OF MICROWAVE POWER WITH ELECTRON-TRANSFER DIODES

Kiev IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: RADIOELEKTRONIKA in Russian Vol 26, No 10, Oct 83 (manuscript received after revision 19 Jul 82) pp 75-77

KOLOMOYTSEV, V. F., KRYS', V. Ya. and SOKOLOVSKIY, I. I.

[Abstract] An experimental study was made of a microwave amplitude modulator using AA 703B electron-transfer diodes, the object being to determine its performance characteristics and the mechanisms on which they depend. The test equipment included a microwave oscillator transmitting continuous signals through a rectifier, an attenuator, a frequency meter, a circulator, and a double-throw switch to either of two modulator cells. Modulated signals were either reflected through one circulator arm, another rectifier, a directional coupler, and a high-precision attenuator to an oscillograph, or transmitted through the other circulator arm and a wideband detector to a milliammeter. A modulator cell consisted of a rectangular waveguide segment 23x3.5 mm^2 in cross section with a Gunn-effect diode inside and three tuning screws inserted through holes in one of the wide walls. Measurements over the 9.95-10.08 GHz operating frequency range have revealed an increase of the modulation factor with increasing microwave signal power at a constant modulation voltage and with increasing modulation voltage at a constant microwave signal power. These results as well as the known demodulation effect in amplifiers with electron-transfer diodes can be explained by asymmetry of the current-voltage characteristics and by a temperature gradient

resulting from heat dissipation (cooling) on the anode side only. Figures 3; references: 12 Russian.
[85-2415]

UDC 621.382.2

STABLE ASYNCHRONOUS TWO-FREQUENCY OSCILLATIONS IN GUNN-EFFECT DIODE WITH OPEN RESONATOR STRUCTURE

Kiev IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: RADIOELEKTRONIKA in Russian Vol 26, No 10, Oct 83 (manuscript received after revision 20 Dec 82) pp 80-82

FURSOV, A. M., BULGAKOV, B. M. and FISUN, A. I.

[Abstract] A two-frequency millimetric-wave oscillator using a Gunn-effect diode and an open resonator structure is designed for independent tuning of both frequencies and for ensuring a stable difference between them. The compound resonator is formed by two identical spherical mirrors (diameter 90 mm, radius of curvature 150 mm) and an echelette reflector (step height = step width = 4 mm, "glare" angle 45°), which actually form two coupled partial resonators. The diode is located directly in the resonator space in the center recess of the echelette so as to allow direct interaction of both partial fields and the active element, oriented at 45° to the echelette for symmetric loading of both partial resonators. Each frequency is regulated by changing the distance of the corresponding mirror from the diode on the echelette. The total power at both frequencies is lower than the power of single-frequency oscillation. Figures 2; references 5: 3 Russian, 2 Western.
[8 -2415]

UDC 621.372.852

HIGH-SPEED PHASE SHIFTER WITH STABLE PHASE STEP

Kiev IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: RADIOELEKTRONIKA in Russian Vol 26, No 10, Oct 83 (manuscript received 17 Feb 83) pp 91-92

SAVCHENKO, V. P. and AFANAS'YEV, A. I.

[Abstract] A discrete microwave phase shifter with a 180° range is described which features a high operating speed and a stable phase step, without use of trimming elements for suppression of parasitic amplitude modulation. It consists of a circular slot with a straight slot terminating into it, two straight conductor strips on the other side of the substrate, one perpendicular and one parallel to the straight slot, and p-i-n diodes located inside the circular slot. Operation of this device is based on utilizing the field

singularities at strip slot transitions. A prototype has been built on Polycor substrate with KA-547 p-i-n diodes. It operates at a power level of 150 mW, with minimum loss within the 7-11 GHz range and minimum standing-wave ratio within the 8-9 GHz range, total loss reducible to below 0.8 dB, and changing the phase step in 3 ns with steady-state phase instability not exceeding 2° and parasitic amplitude modulation not exceeding 0.3 dB over at least 30% of the operating frequency range. The phase shifter can also operate as an efficient amplitude modulator with diode voltage commutation. Figures 2; references 2: 1 Russian, 1 Western.
[85-2415]

UDC 621.382.2.029.64

INTERMODULATION IN PROTECTIVE SEMICONDUCTOR MICROWAVE DEVICES

Kiev IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: RADIOELEKTRONIKA in Russian Vol 26, No 10, Oct 83 (manuscript received 24 Mar 83) pp 92-94

ROPIY, A. I.

[Abstract] For protection of low-noise microwave input amplifiers with low power stability one commonly uses semiconductor devices with limiting diodes in the output stages. These diodes can, however, distort the spectrum of low-power signals in a receiver. This distortion, of the intermodulation kind, results from interaction of signal and interference at the output of a diode state. The power of third-order intermodulation components was measured, for design optimization purposes, using diodes of two sizes with the base layer 4 μm and 20 μm, respectively. In one experiment a diode was connected into a microstrip line in the low-pass filter configuration with transmission losses not exceeding 0.6 dB over 66% of the frequency band. This variant was tested in the decimetric-wave range. In another experiment a diode was connected into a rectangular waveguide of 10x23 mm^2 cross section through a coaxial quater-wavelength transformer segment with transmission losses not exceeding 0.8 dB over 6% of the frequency band. This variant was tested in the centrimetric-wave range. According to the results of measurements, the dependence of the third-order intermodulation power on input power in either case with diodes of either size can be approximated as a linear one, with a slope of about 1:3. The concept of "intersection point" on the intermodulation-input power diagram, although devoid of definite physical significance, can serve to characterize unambiguously the level of intermodulation distortion. Figures 1; references 5: 2 Russian, 3 Western.
[85-2415]

UDC 621.373.12.029.6

PROBLEM OF STATIONARY STATE OF MICROWAVE SELF-EXCITED GENERATOR OF BROADBAND STOCHASTIC OSCILLATIONS

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 28, No 12, Dec 83
(manuscript received 13 Nov 81; after revision 16 Mar 83) pp 2423-2429

MYASIN, Ye. A. and PANAS, A. I.

[Abstract] The results are given of experimental investigations which indicate the possibility of considering the stationary state of a microwave self-excited generator of broadband stochastic oscillations as the superregnerative state of a nonlinear amplifier with a broadband delayed feedback circuit (BDFC). This exhibits the fact that amplification with respect to the small harmonic signal in it is smaller than a stochastic large signal arriving at the generator along the line of the BDFC. Figures 6; references: 11 Russian. [104-6415]

UDC 621.397

EVALUATION OF THE LIMITING ACCURACY IN DETERMINING THE COORDINATES OF A POINT LIGHT SOURCE BY A TELEVISION TRACKING SYSTEM USING AN IMAGE DISSECTOR WITH THE PRESENCE OF A NONSTATIONARY CURRENT COMPONENT

Leningard IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: PRIBOROSTROYENIYE in Russian Vol 27, No 1, 1984 (manuscript received 21 Apr 83) pp 29-34

[Article by V. I. Tislenko and Yu. V. Martyshevskiy, Tomsk Institute of Automated Systems of Control and Radio-Electronics]

[Text] The problem of evaluating the potential accuracy of determining the coordinates of a point light source by a television tracking system using an image dissector is solved on the basis of the method of the Markov nonlinear theory of filtration. The results obtained take into account the effect of a nonstationary component of the dissector current and are correct over a wide range of contrast values.

Television tracking systems (TSS) using a dissector find broad application in determining the coordinates and and tracking point light sources connected with laser detection and ranging. At present a number of papers (References 1,2) have been devoted to the matter of analyzing the potential accuracy of such devices. As a rule in those papers, however, a steady-state condition for the noise generated by the dissector is assumed which can be justified only with low-contrast sources or in conducting the analysis of the accuracy of determining the coordinates with a given linear structure of the filter (References 3,4) which lowers the significance of the results. The development of the modern component base for microprocessors and microcomputers raises new problems in the analysis of the qualitative characteristics and the synthesis of the structure of television tracking systems which operate under conditions of a whole complex of random input effects.

This paper presents an evaluation of the limiting accuracy in determining the coordinates of a point light source by the method of the Markov theory of optimum nonlinear filtration. The fluctuations of the current of the output signal of the dissector caused by its own noise are considered as a source of the errors of the tube.

A feature of a television detector using a dissector is that the intensity of the current fluctuation at the output depends on the mean value of the level of illumination (Reference 2). The total current from the dissector can be represented as an additive sum:

$$Y(t)=S(t)+n(t)=aS_0[\lambda(t),\ t]+n_s(t)+n(t), \qquad (1)$$

where: n(t) is the white Gaussian noise caused by the presence of hum (background noise), $n_s(t)$ is the white Gaussian noise caused by the presence of the useful signal (signal noise), $\lambda(t)$ is the useful information (the change of the coordinates of the TSO [point light source]), $S_0(t)$ is a normalizing function determining the mean current of the useful signal, and a is the value of the mean current of the useful signal at the maximum of the signal fluctuation.

The Gaussian noises n(t) and $n_s(t)$ are assumed to be statistically independent since they are not causally generated by the related luminous fluxes, the hum and the signal. The total spectral density of the power of the fluctuation of the current at the output of the dissector during a constant background level is:

$$N(t)=N_0+N_s(t)=N_0(1+p/(1-p)S_0(\lambda(t),\ t)), \qquad (2)$$

where: $N_0(t)$ is the spectral density of the power of the background noise, $N_s(t)$ is the spectral density of the power of the nonstationary signal noise, and p is the electrical contrast.

Thus, the fluctuating signal at the output of the dissector contains informative nonstationary white Gaussian noise. The correlation function of the fluctuating current accordingly, (Reference 2) has the form:

$$R(t,\tau)=N(t)\delta(t-\tau)=N_0(1+p/(1-p)S_0(\lambda(t),\ t))\delta(t-\tau), \qquad (3)$$

where: $\delta(t-\tau)$ is the delta function of Dirak.

The presence of the observed signal (1) of nonstationary noise having a spectral density depending on the power of the information substantially complicates the analysis of the potential accuracy of the measurement of the coordinates and the synthesis of the structure of an optimum tracking system. In the analysis of the accuracy of the measurement of the coordinates of the point light source, it will be considered that a stationary Markov Gaussian process of the first order is an adequate model of the information. This Markov Gaussian process of the first order has the correlation function:

$$R_\lambda(\tau)=\sigma_\lambda^2 e^{-\alpha_0|\tau|}, \qquad (4)$$

where: α_0 is the magnitude of the reverse interval of the correlation of the information and σ_λ^2 is the dispersion of the process $\lambda(t)$.

For the analysis of the accuracy and the synthesis of the structure of the television tracking system in accordance with equations (1), (3), and (4) let us write down the equations of condition X(t) and of observation Y(t), taking into account in so doing that $\lambda(t) = x_1(t)$:

$$\dot{x}_1(t) = -\alpha_0 x_1(t) + \sigma_1 \sqrt{2\alpha_0} n_1(t), \tag{5}$$

$$Y(t) = aS_0(x_1, t) + \sqrt{N_0(1+p)/(1-p)\, S_0(x_1, t)}\, n_0(t), \tag{6}$$

where: $n_1(t)$ and $n_0(t)$ are statistically independent white Gaussian noises having unit spectral density, and σ_1^2 is the dispersion of $x_1(t)$.

A feature of the given problem by comparison with that stated in equation (5) is that the observations (2) contain nonstationary "signal noise" with a spectral density depending on the process being evaluated.

Two variants for the solution of this problem are proposed.

1. As the component $n_s(t)$ of the noise of the observations carries data about the information $x_1(t)$, let us transform equation (1) into the form:

$$Y(t) = aS_0(x_1(t), t) + \sqrt{aS_0(x_1(t), t)}\, n_{0s}(t) + \sqrt{N_0} n_0(t), \tag{7}$$

where: $n_0(t)$ is the white stationary noise of the observations with unit spectral density, and $n_{0s}(t)$ is Gaussian "signal noise" with unit spectral density.

It seems advisable to take account of the noise component of the signal by the introduction of an additional process, $x_2(t)$, having properties close to white noise. In that case, equation (7) has the form:

$$Y(t) = aS_0(x_1(t), t) + \sqrt{aS_0(x_1(t), t)}\, x_2(t) + \sqrt{N_0} n_0(t), \tag{8}$$

where: $x_2(t)$ is a Gaussian Markov process with unit intensity satisfying the equation:

$$\dot{x}_2(t) = -\beta_0 x_2(t) + \beta_0 n_2(t), \tag{9}$$

where: $n_2(t)$ is white normal shaping noise. The parameter β_0, which determine the correlation properties of the process statisfies the condition:

$$\alpha_0^{-1} \gg T_u \gg \beta_0^{-1}, \tag{9a}$$

where T_u is the duration of the video signal at a level 0.606a. The problem thus comes down to the evaluation of the vector of information:

$$X(t) = |x_1(t), x_2(t)|^T,$$

which satisfies equations (5) and (9) and is nonlinearly connected with the observed signal (8). For equations (5), (8), and (9),with a Gaussian approx-

imation of the empirical probability density of the vector X(t), the optimum evaluation, in a root-mean-square sense, of the vector X(t) is determined in discrete time by means of equations of forecasting and correction (6)

$$\hat{X}(k+1/k)=\Phi\hat{X}(k),$$

$$\hat{X}(k+1)=\hat{X}(k+1/k)+K(k+1)\{Y(k+1)-S[\hat{X}(k+1/k),\ k+1]\}, \quad (10)$$

where: $S[\cdot]=aS_0[\hat{x}_1(k+1/k),\ k+1]+\sqrt{aS_0[\hat{x}_1(k+1/k),\ k+1]}\hat{x}_2(k+1/k)$ is the non-linear function of the observations.

The matrix of transformation of a discrete system is:

$$\Phi=\begin{vmatrix} 1-\alpha_0\Delta t & 0 \\ 0 & 1-\beta_0\Delta t \end{vmatrix}, \quad (11)$$

where Δt is the time interval of digitization.

The coefficient of reinforcement of a dynamic filter is:

$$K(k+1)=D(k+1)\dot{S}N_0^{-1}\Delta t, \quad (12)$$

where: $\dot{S}=\frac{\partial S[\cdot]}{\partial\hat{X}(k+1/k)}$, is the vector-row gradient of the scalar function of the observations.

The matrix of covariation of the evaluation is:

$$D(k+1)=D(k+1/k)-D(k+1/k)\dot{S}^T(k+1/k)\times$$
$$\times[\dot{S}(k+1/k)D(k+1/k)\dot{S}^T(k+1/k)-N_0/\Delta t]^{-1}\times$$
$$\times\dot{S}(k+1/k)D(k+1/k). \quad (13)$$

The empirical matrix of covariation of the errors is: $D(k+1/k)=\Phi D(k)\Phi^T+G$, where the matrix:

$$G=\begin{vmatrix} \sigma_1^2 2\alpha_0\Delta t & 0 \\ 0 & 2\beta_0\Delta t \end{vmatrix}. \quad (14)$$

For the realization of the algorithms of the formation of the evaluation in conformity with equations (10) - (14), it is necessary to assign initial values for the vector and the matrix of covariation $\hat{X}(0)$, D(0).

The other way of solving the problem specifies the consolidation of the independent noises $n_s(t)$ and n(t) and the writing down of the observed signal in the form of equation (6) with subsequent replacement in equation (2) of the information x(t) by its evaluated value. The observations take the form:

$$Y(t)=aS_0[x_1(t),t]+\sqrt{N_0(1+p/(1-p)S_0[\hat{x}_1(t),\ t]}n_0(t). \quad (15)$$

Thus, the spectral density of the white noise in the observations is a known function, and the problem is taken into the general theory of nonlinear Markov filtration (Reference 5). Here, the information is a scalar function. The discrete equations for the evaluation of the coefficient of reinforcement of the filter and the dispersion of the errors have the form:

$$\hat{x}_1(k+1) = (1-\alpha_0\Delta t)\hat{x}(k) + K(k+1)\{Y(k+1) - aS_0[\hat{x}_1(k+1/k),\ k+1]\},$$
$$K(k+1) = D(k+1)aS_0N^{-1}[\hat{x}_1(k+1/k),\ k+1]\,1/\Delta t.$$
$$D(k+1) = D(k+1/k) - a^2D^2(k+1/k)\left[\frac{\partial S_0}{\partial \hat{x}_1(k+1/k)}\right]^2 \times \qquad (16)$$
$$\times\left\{\left(\frac{\partial S_0}{\partial \hat{x}_1(k+1\ k)}\right)^2 a^2D(k+1/k) + N[\hat{x}(k+1/k, k+1]\,1/\Delta t,\right.$$
$$D(k+1/k) = (1-\alpha_0\Delta t)^2D(k/k) + \sigma_1^2 2\alpha_0\Delta t.$$

The structure of the optimum dynamic filter is determined by equations (10), (12), (13), (14), or (15) and is presented in Figure 1 where K(k + 1) is the coefficient of reinforcement, $\partial/\partial x$ is the differentiating operator, $\Gamma\Phi$ is the signal shape generator, $\Im$ is an extrapolator with the transfer function $(1-\alpha_0\Delta t)$, $БЗ$ is the delay block, and $(\cdot)^{-1}$ is the divisor. The nature of the filters is displayed in the pattern of the calculations carried out by the blocks.

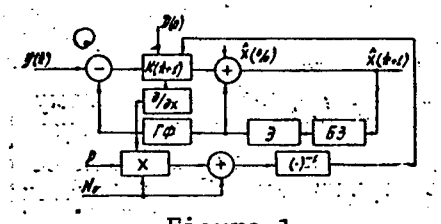

Figure 1.

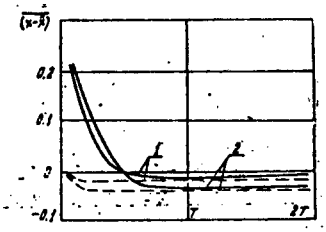

Figure 2.

The numerical results of the analysis of the potential accuracy were obtained from processing by the method of direct probability modelling of the algorithms on a computer. The shape of the video signal $S_0(t)$ formed in scanning for the point light source was approximated as a Gaussoid with a duration $T_u = 1/2\ T$, where T is the duration of the scanning interval. The quantities Δt, σ_1, α_0^{-1}, having the dimensions of time, are normalized to the duration of the scanning interval which is taken equal to unity.

By empirical repetitions of the calculations, the normalized value for the interval of digitization was taken equal to 0.05. With this, the digitization error did not exceed 3 percent.

Figure 2 shows the change of the averaged error of filtration $\overline{(x_1-\hat{x}_1)}$ with the value $\Psi_\Delta = 12$ in two-cycle scanning. The solid lines correspond to fixed initial conditions and the dashed lines to averaging over a group of initial conditions. In all cases, the averaging was carried out over 100 realizations of the random process.

The initial values of the evaluations are equal to the mean values of the processes $x_1(t)$ and $x_2(t)$; that is, $\hat{x}_1(0)=0$, $\hat{x}_2(0)=0$. The initial values of the elements of the covariation matrix amounted to $D_{11}(0) = 0.2$ and $D_{22}(0)=1$,

$D_{12} = D_{21} = 0$ which corresponds to the properties adopted earlier for the processes $x_1(t)$ and $x_2(t)$ and to the apriori assumption of the presence of the television tracking system in a single interval of scanning.

The calculations were carried out for typical normalized values of the parameters of information: $\sigma_1/\bar{T}=0,1$, $\alpha=\alpha_0 T=1/7$. . Curves 1 and 2 on Figures 2 - 4 correspond respectively to filters realized by the first and second variants of the method.

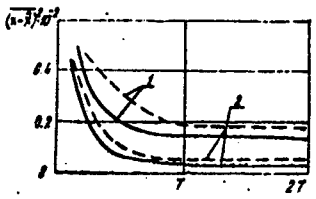

Figure 3.

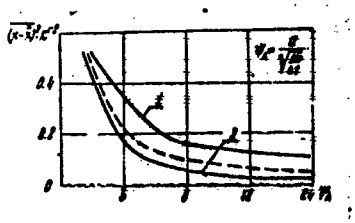

Figure 4.

Averaging by random initial conditions, $\hat{x}_1(0)$ and $\hat{x}_2(0)$ was carried out with their normal distribution determining the true realizations of the information $x_1(t)$ and $x_2(t)$. The condition (9,a) was fulfilled with the value $\beta_0 T=15$.. In the calculations, the magnitude of the signal to noise ratio, Ψ_A was taken equal to the ratio of the amplitude of the video signal to the intensity of the background noise.

The results shown in Figures 2 - 4 demonstrate the rather quick convergence of the proposed algorithms.

Even though the algorithms obtained give an approximately identical evaluation of the potential accuracy, the filter by the first variant turns out to be two-dimensional and requires a large amount of calculation.

The obtained results can be used in validating the requirements for the technical characteristics of television tracking systems using a dissector.

BIBLIOGRAPHY

1. Ward John H., "Acquisition and Tracking in Optical Data Links""Eascon-75 Rec IEEE. Electronic and Space Systems", convened in Washington, D. C., 1975, pp 496-518.

2. Vereshkin A. Ye., "On the Determination of the Correlation Function of Nonstationary Noise in Dissector and Superorthicon Cameras", RADIOTEKHNIKA I ELEKTRONIKA, 1969, No.12, pp 2257-2259.

3. Vereshkin A. Ye., "A Design Model of a Television Tracking System Using a Dissector with Time Sampling of Signals of Mismatch", TEKHNIKA SREDSTV SVYAZI, SERIYA TEKHNIKA TELEVIDENIYA, 1978, Issue 1, pp 3-11.

4. Mitryashkin V. I., Pustynskiy I. N., "Fil'tratsiya televizionnogo signal ot tochechnogo ob"yekta mnogozvennoy RC-tsepyu v nestatsionarnom shume." [Filtering the Television Signal from a Point Light Source in Nonstationary noise by Means of a Ladder-Type RC-circuit.", in the collection: Televizionno-vychislitel'nyye ustroystva, Tomsk, Publishing house of the Tomsk State University, 1981.

5. Yarlykov M. S., "The Use of the Markov Theory of Nonlinear Filtration in Radio Equipment", Moscow, Sovetskoye Radio press, 1980, 375 pages.

6. Seydzh E., Mels Dzh., "Teoriya otsenivaniya i ee primeneniye v svyazy i upravlenii" [The Theory of Evaluation and Its Use in Communications and Control] Moscow, Svyaz press, 1976, 492 pages.

9136
CSO: 8144/0881

UDC 621.37/39:534.001

ACOUSTOOPTICAL INTERACTION IN ANISOTROPIC MEDIUM

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 28, No 10, Oct 83
(manuscript received 28 Jun 82) pp 1907-1913

NIKANOROVA, Ye. A. and PARYGIN, V. N.

[Abstract] Diffraction of light by ultrasound in an anisotropic medium is analyzed on the basis of exact equations for the amplitudes of diffraction peaks. This system of equations is solved in the Bragg approximation, assuming that the variable part of the dielectric permittivity tensor alternates sinusoidally during propagation of an acoustic wave. The medium is assumed to be nonmagnetic and optically transparent, containing no free charges. Only waves propagating in the positive direction after diffraction are considered in the solution of the corresponding wave equation, rather than an infinite series of plane waves. The solution takes into account deviation of the phase velocity of the ultrasound from its group velocity, it also takes into account the interaction of diffraction peaks. In the special case of collinear group and phase velocities the problem is solved for boundary conditions which account for the length of the acoustooptic interaction space. Figures 3; references 7: 5 Russian, 2 Western
(1 in Russian translation).
[84-2415]

UDC 621.372.88:621.37/39:534

FAN-SHAPED INTERDIGITATED SURFACE ACOUSTIC WAVE TRANSDUCER WITH CAPACITIVE WEIGHTING OF ELECTRODES

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 28, No 12, Dec 83
(manuscript received 26 Mar 82) pp 2464-2466

ROZHDESTVENSKIY, A. N.

[Abstract] A method is considered for quantitative evaluation of the characteristics of the radiative directivity of a fan-shaped interdigital

transducer (FSIT) with capacitive weighting of electrodes. The experimental investigation was conducted on a surface acoustic wave device made on a foundation of lithium niobate, of a XZ cut with dimensions 20 x 1 x 30 mm (X,Y,Z). On the basis of this investigation, it is possible to assume that the level of the radiation side lobes of the FSIT in the experimental unit amounted to -28 ÷ -30 db. The good keeping quality of the form of the frequency characteristics during operation of the FSIT on various elements of the receiver array is notable. This corresponds to the preservation of the form of the acoustic beam during its frequency scanning in the FSIT. A decrease of the level of the lateral radiation of the FSIT by means of its weighting treatment substantially extends the possibility of using such transducers in functional microelectronic devices, in particular for construction of programmed filters with a controlled form of frequency characteristic, in frequency discriminators, as well as in nonfailing control devices based on scanning of an acoustic beam. Figures 2; references 4: 3 Russian, 1 Western in Russian translation.
[104-6415]

UDC 621.391.825:621.373

GENERATORS OF RANDOM PROCESSES IN WALSH BASIS

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 28, No 10, Oct 83 (manuscript received 30 Dec 81) pp 1914-1920

VOROB'YEV, G. N. and SYUZEV, V. V.

[Abstract] The precise algorithm of simulating stationary random processes with a given spectral distribution function through representation of such a process as the sum of independent random quantities in the form of a trigonometric series is extended to discrete stationary random processes and simplified by representation in the basis of Walsh-Harmuth functions. A generator of such random processes in this basis is synthesized in two variants. In the parallel variant, where all terms of the series are calculated simultaneously, the random number generator is followed by a commutator consisting of an array of modulo-2 (+) adders and the latter by sign reversing devices before the output summator. In the sequential variant the random number generator is followed by an array of modulo-2 adders, each followed by an AND logic into which the Walsh function generator feeds through a decoder, then an OR module and a sign reversing device before the output summator. The parallel variant operates at a higher speed but requires more hardware then the sequential one. Figures 2; references: 6 Russian (2 concerned with foreign radioelectronics).
[84-2415]

UDC 535.824.2:535.822

DESIGN OF OBJECTIVES FOR OPTICAL DISK MEMORIES

Leningrad IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: PRIBOROSTROYENIYE in Russian Vol 26, No 11, Nov 83 (manuscript received 28 Jun 83) pp 84-87

NIKIFOROVA, G. L., Leningrad Institute of Precision Mechanics and Optics

[Abstract] The modular method of designing microscope objectives (V. A. Panov and L. N. Andreyev, OPTIKA MIKROSKOPOV, Izd-vo Mashinostroyeniye,

Leningrad, 1958) is extended to the design of objectives for optical disk memories. Such an objective is synthesized in three modules: a plane-parallel plate as a protective-corrective device, an aplanatic meniscus, one plano-convex lens or two of them as a scaler-compensator. The plate in front introduces positive spherical aberration, the meniscus introduces spherical abberation as well as coma and also decreases the numerical aperture, the plano-convex lens set compensates both sperical aberration and coma while adjusting the objective to the proper focal length. The basic design parameters are the meniscus radii, taking into account thickness of and distance from the plate, and distance from the meniscus to the plane surface of the lens set with paraxial segments taken into account. Aberration is calculated separately for the front part (plate + meniscus) along the forward path and for the back part (lens set) along the reverse path. The corrections, in terms of linear and angular dimensions, are established on this basis and then implemented by either bending the scaler-compensator lens set or changing the thickness of the protective-corrective plate. Optical objectives with numerical apertures from 0.4 to 0.7 have been designed by this method, their noteworthy feature being not only use of aplanatic surface segments but also absence of diverging lenses. The paper is recommended by the Chair (Kafedra) of Optical Devices. Figures 2; tables 1; references: 5 Russian.
[87-2415]

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