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USSR Report

ELECTRONICS AND ELECTRICAL ENGINEERING

(FOUO 7/81)

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USSR REPORT

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CONTENTS

CERTAIN ASPECTS OF COMPUTER HARD AND SOFT WARE: CONTROL, AUTOMATION, TELEMECHANICS, TELEMETERING, MACHINE DESIGNING AND PLANNING

UDC 621.311.621.316.621.314.629.396

APPLICATIONS OF COMPUTER EQUIPMENT AND AUTOMATION IN ELECTRICAL POWER SYSTEMS

Kiev PRIMENENIYE VYCHISLITEL'NOY TEKHNIKI I AVTOMATIZATSIYA V ELEKTROENERGETICHESKIKH SISTEMAKH in Russian 1980 (signed to press 14 Oct 80) pp 2, 215-224

[Annotation and abstracts of papers in the collection "The Application of Computer Equipment and Automation in Electrical Power Engineering Systems", editor-in-chief L.V. Tsukernik, Izdatel'stvo "Naukova dumka", Institute of Electrodynamics of the Ukrainian SSR Academy of Sciences, 800 copies, 224 pages]

[Text] Questions of the development of procedures, algorithms and programs (including comprehensive programs using a single data base) for the calculation of the normal and emergency modes of complex electrical power systems are treated in this collection. Urgent problems of relay protection as well as the design and study of automation and remote control devices are also analyzed.

The collection is intended for scientific, engineering, technical workers, electrical power engineers and specialists in the application of computers to electrical power engineering; it will also be useful to students of the higher educational institutes in electrical power engineering specialties.

UDC 621.311.011.1

A PROCEDURE FOR THE ANALYSIS OF LONG DURATION ELECTROMECHANICAL TRANSIENT PROCESSES IN A POWER SYSTEM IN THE CASE OF DISTURBANCES WHICH LEAD TO LARGE FREQUENCY CHANGES

[Abstract of paper by Avramenko, V.N. and Olyanishin, V.A.]

[Text] A procedure is proposed for the analysis of long duration electromechanical transient processes with significant frequency excursions; the possibilities for realizing it with the ChASTOTA-1 program are indicated and the results of calculations as well as comparisons with program analysis of the dynamic stability of the UDAR-2m are given. Figures 4; references 10.

UDC 621.311.1

AN ALGORITHM AND COMPUTATIONAL ROUTINE FOR THE STEADY-STATE MODES OF POWER SYSTEMS TAKING INTO ACCOUNT A SPECIFIED OR OPTIMALIZING FREQUENCY

[Abstract of paper by Sukhenko, V.I.]

[Text] A method is developed for the calculation of the steady-state modes of a power system, taking its frequency characteristics into account. Special attention is devoted to accelerating the rate of convergence of Newton's method in calculating the optimalizing frequency. The question of accounting for the available reactive power of synchronous generators is analyzed in the calculations of the steady-state modes of power systems. References 9.

UDC 621.316.925

THE CALCULATION ON THIRD GENERATION COMPUTERS OF THE OPERATING CONDITIONS INVOLVING INCOMPLETE PHASES IN COMPLEX ELECTRICAL NETWORKS

[Abstract of paper by Krylov, V.A. and German, A.I.]

[Text] An algorithm developed for the calculation of operating modes with incomplete phases in complex power grids is analyzed. The basis for the algorithm is the insertion of an additional voltage source in the switched branch in the original symmetrical network. The industrial program compiled for third generation computers in which the algorithm considered here is realized is described. References 3.

UDC 621.316.001.24

THE CALCULATION OF THE PRE-EMERGENCY CONDITIONS IN COMPLEX POWER SYSTEMS WITH A LARGE NUMBER OF NODES FOR THE SUBSEQUENT CALCULATION OF THE SHORT CIRCUIT CURRENTS CURRENTS

[Abstract of paper by Khrushchova, Ye.V. and Krylov, V.A.]

[Text] An algorithm for one of the variants of Newton's method is described as applied to calculations of the pre-emergency conditions in complex power systems. The computational results are intended for the subsequent calculation of the short circuit current. References 4.

UDC 621.311

THE DEVELOPMENT OF AN OPERATIONAL EXPERIENCE WITH COMPLEXES FOR DETERMINING THE EQUIVALENT CIRCUITS FOR THE CALCULATION OF STEADY-STATE OPERATING MODES

[Abstract of article by Kachanova, N.A., Kozlenko, A.N., Makarevich, R.A. and Perga, S.P.]

[Text] The following equivalent circuit design complexes are described: a) The "Ekvis-4", which is interfaced with the "Set'" program for steady-state operational mode calculations, developed by the TsDU [central dispatcher control] of the

YeES [unified power system] of the USSR; b) The "Ekvis-5", which is interfaced with a variant of the "Set'" program for steady-state operational mode calculations, developed by the Institute of Electrodynamics of the Ukrainian SSR Academy of Sciences; c) The "Ekvis-6", which is interfaced with the "RUER" program for steady-state operating mode calculations, developed by the ODU Yug [southern integrated dispatcher control]. The volume of problems which can be solved: the original circuit - 1,000 nodes; the equivalent circuit region - 500 nodes. The complexes are written in FORTRAN-4 for unified series computers and the M-4030. Figures 4; tables 2; references 9.

UDC 621.311

A PROGRAM FOR SELECTIVELY DETERMINING EQUIVALENT CIRCUITS OF A NETWORK TO CALCULATE STEADY-STATE MODES

[Abstract of paper by Kachanova N.A. and Kozlenko A.N.]

[Text] A program for selectively determining an equivalent circuit is described, which includes the following operations: the transformation of parallel lines, the exclusion of radial lines and the exclusion of nodes having two ties to adjacent nodes. An example of a calculation using the program is given. The program is written in FORTRAN-4 for the unified series of computers and the M-4030. Figures 2; tables 3.

UDC 621.311:001.33:001.57

THE GENERATION OF A LIBRARY OF CALCULATED STEADY-STATE OPERATIONAL MODES FOR ELECTRICAL POWER SYSTEMS

[Abstract of paper by Chernenko, P.A. and Zorin, V.V.]

[Text] The construction of a library of operational modes which have been calculated beforehand (BR) is described. Methods of classifying the operational modes are treated, as well as the ascertaining of the significant criteria. The operating mode library is intended for the storage and output on displays of information on the steady-state mode based on a specified complete or limited set of significant criteria and can also be used in the operation and plannning of electrical power systems. References 4.

UDC 621.391.2:621.311.1

THE SPECIALIZED IVS-IED INFORMATION COMPUTER SYSTEM

[Abstract of article by Zharkin, V.F., Kuz'min, I.A. and Rudenko, P.N.]

[Text] The general concepts of the development of the specialized IVS-IED information computer system are proposed. The requirements placed on specialized information computer systems are formulated. The principles of program dispatcher control of the information computer process are worked out based on the input language for the control of the information computer system operation. Figures 1; references 3.

UDC 621.311.001

THE STRUCTURE OF A DATA BASE FOR THE SOLUTION OF ELECTRICAL ENGINEERING PROBLEMS

[Abstract of article by Kosterev, N.V., Tsyganov I.V. and Tseplyayev, V.G.]

[Text] A formal description is given for the information file of a data base. Its logic structure is presented. The universal nature of its applications is demonstrated. Figures 2; references 5.

UDC 621.311.001.57

QUESTIONS IN THE DEVELOPMENT AND DEBUGGING OF MULTIPHASE PROGRAMS (USING THE EXAMPLE OF THE DEVELOPMENT OF A COMPREHENSIVE PROGRAM FOR THE ANALYSIS OF THE STATIC STABILITY OF COMPLEX POWER SYSTEMS)

[Abstract of article by Korobchuk, K.V., Sambur, S.B. and Khimyuk, I.V.]

[Text] Experience with the organization of the programming, interfacing and comprehensive debugging of large multiphase programs is brought to light. The methods employed by the authors in the development and debugging of a comprehensive program using a third generation computer to analyze the statistical stability of complex power systems, the STATUS program, is described; this program incorporates a number of algorithmically complex and voluminous routines (in terms of the program realization and the large amount of input and intermediate data which is used), which are oriented towards the practically complete utilization of the immediate-access memory of the computer in the case of autonomous use. The solutions employed by the authors in interfacing the programs written in different programming languages are set forth (FORTRAN-4 and the ASSEMBLER language). Figures 2; references 5.

UDC 621.391.2:621.311.1

AN ADAPTATION TECHNIQUE FOR THE INFORMATION MODELS OF POWER SYSTEMS

[Abstract of paper by Zharkin, V.F. and Rudenko, P.N.]

[Text] The operational mode for making corrections and changes in the parameters of power system models is described. A definition is given for the adaptation for information models of power systems. A generalized adaptation algorithm is proposed based on an information retrieval system using standardized data structures in the information models. Figures 1; references 2.

UDC 621.391.2:621.311.1

THE DESIGN OF A UNIT TO INTERFACE THE "STATUS" COMPREHENSIVE PROGRAM FOR THE ANALYSIS OF STATIC STABILITY TO THE SPECIALIZED IVS-IED INFORMATION COMPUTER SYSTEM

[Abstract of article by Trokhimenko, A.I.]

[Text] One of the variants of a unit for interfacing the program for static stability analysis to an information computer system (the IVS-IED) is proposed. Its algorithm is described. The advantages of running the "STATUS-O" program in conjunction with the IVS-IED are demonstrated. Figures 1; references 3.

UDC 621.311.016.35

ON THE DEGENERATION OF THE CHARACTERISTIC EQUATION OF MATHEMATICAL MODELS AND THE PROBLEM OF POWER SYSTEM STABILITY

[Abstract of article by Kostyuk, O.M.]

[Text] The question of the degeneration of the characteristic equation of a power system is discussed where this dengeneration occurs as a result of neglecting small parameters. It is emphasized that the degenerate equation solves the problem of original system stability and is therefore of practical importance, if the tending of the small parameters to zero carries away part of the roots of the total (nondegenerate) equation to infinity to the left of the imagined axis. However, if a portion of the roots is shifted to the imaginary axis or to a small neighborhood of it and there are no right roots, which are sufficiently remote from the imaginary axis, then the degenerate equations of the stability problem is not solved (a special case similar to Lyapunov's special case). It is shown that such is the characteristic equation of the positional model of a power system. References 12.

UDC 621.313.322

A STUDY OF A METHOD OF MATHEMATICALLY PROCESSING THE RESULTS OF AN EXPERIMENT TO DETERMINE THE TRANSIENT PARAMETERS OF SYNCHRONOUS GENERATORS

[Abstract of article by Tverdyakov, V.V.]

[Text] Likelihood criteria are analyzed, which limit the order of the mathematical model of a synchronous generator derived on the basis of the results of specially organized experiments. Figures 1; tables 1; references 9.

UDC 621.317

THE APPLICATION OF GENERAL PURPOSE COMPUTERS TO THE MEASUREMENTS OF ELECTRICAL POWER LOSSES IN 750 KV NETWORKS

[Abstract of article by Neyman, V.A. and Kuznetsov, G.G.]

[Text] A method and an algorithm for the estimation of electrical power losses in 750 KV networks using general-purpose computers are presented, which make it possible to reduce the estimate error by an order of magnitude as compared to the error of the existing estimation technique. The economic impact on the international 750 KV electrical power transmission line from the introduction of the proposed algorithm is discussed. Figures 2.

UDC 621.311:621.3.016.312:621.372

POWERING THE RAPIDLY CHANGING LOADS OF AN AUTONOMOUS POWER SYSTEM THROUGH SYMMETRICAL COMPONENT FILTERS

[Abstract of article by Vasetskiy, V.M. and Tsukernik, L.V.]

[Text] A method of powering a rapidly changing load through symmetrical component filters is described, in which the impact of the symmetrical rapidly changing load on the power supply operating conditions is practically eliminated, something which boosts the operational reliability as well as the electrical quality in independent power systems. Figures 5; references 4.

UDC 621.314.224

ON THE CHOICE OF THE OPERATING MODE OF AN ELECTROMAGNETIC CURRENT CONVERTER IN RELAY PROTECTION AND AUTOMATION DEVICES

[Abstract of article by Stogniy, B.S. and Slyn'ko, V.M.]

[Text] The amplitude-frequency and phase-frequency characteristics of an electromagnetic measurement current transducer (IPT) are derived, where the transducer operates as a current transformer and a transreactor. The change in the current and angular errors of the IPT is analyzed for the case of a change in the temperature conditions, and the promise of the application of a transreactor to power relay protection and automation devices is demonstrated. Figures 6; references 7.

UDC 621.314.224

ON THE QUESTION OF THE CRITERIA FOR THE EVALUATION OF THE OPERATION OF CURRENT MEASUREMENT TRANSDUCERS IN RECTIFIER CONVERTER CIRCUITS

[Abstract of article by Chernenko, V.A. and Vaynshteyn, Yu.A.]

[Text] Expressions are derived which establish the relationship between the quantities characterizing the operation of a measurement current transducer in the steady-state mode. A conclusion is drawn concerning the possibility of evaluating the operation of a measurement current transducer based on only one criterion. Figures 3; tables 1; references 2.

UDC 621.314.224

AN ALGORITHM TO GENERATE EQUATIONS FOR THE CIRCUIT MODEL OF CURRENT MEASUREMENT TRANSDUCERS

[Abstract of article by Stogniy, B.S., Kirilenko, A.V. and Levitskiy, V.G.]

[Text] The major standard components are determined which are the basis for the design of electromagnetic current measurement transducers (IPT). A technique is proposed and an algorithm is described for the generation of the circuit model of a measurement current transducer, which utilizes information on its standard components and makes it possible to study devices of any configuration which are treated here. Figures 1; tables 1; references 8.

UDC 621.314.224

THE DETERMINATION OF TOLERANCES IN THE PRODUCTION OF LINE CURRENT TRANSFORMERS

[Abstract of article by Stogniy, B.S. and Orobets, Yu.N.]

[Text] Design expressions are derived for the determination of the ultimately permissible mean square deviations and tolerances of the major production parameters of line current measurement transducers. An example of the calculation of the tolerances of a single stage line current transformer is given. Figures 4; tables 1; references 6.

UDC 631.316.925

THE PULSE-WIDTH MODULATOR IN THE INFORMATION TRANSDUCERS OF DIGITAL RELAY PROTECTION DEVICES

[Abstract of article by Kholodenko, Yu.N.]

[Text] The requirements placed on a pulse-width modulator as an element in an information transducer for digital relay protection devices are analyzed. A modulator circuit is proposed. A number of the parameters and properties of the modulator are also analyzed, in particular, the conversion error. Figures 5; references 8.

UDC 621.398:621.391.3

AN ANALYSIS OF THE OPERATING MODES OF A TRANSMITTER OF A REMOTE CONTROL SYSTEM TRANSMITTING VIA DISTRIBUTION NETWORKS

[Abstract of article by Koshman, V.I.]

[Text] The operation of a transmitting device, designed in the form of a flip-flop with an active inductive load in the legs of the circuit is analyzed and the conditions for its optimal operation are ascertained. Recommendations are made concerning the selection of the basic parameters of the flip-flop. The efficiency of the transmitter is determined. Figures 4; references 2.

UDC 621.398:621.391.3

A STUDY OF VOICE-FREQUENCY INTERFERENCE IN THE DISTRIBUTION NETWORKS OF AN IRRIGATION COMPLEX

[Abstract of article by Koshman, V.I. and Trach, I.V.]

[Text] The results are given for an experimental study of the harmonics and pulse noise occuring in the distribution network of an irrigation complex for various operational conditions of the complex. Figures 4; tables 2; references 6.

UDC 621.317.08

A METER FOR THE TRIGGERING ANGLES OF THE RECTIFIERS OF THE TRANSMITTER OF AN EMERGENCY CIRCULAR LOAD RELIEF SYSTEM

[Abstract of article by Buslov, L.I., Osnach, A.M. and Shestopalov, V.N.]

[Text] A meter for the triggering angles of the rectifiers of the transmitter of an emergency circular load relief system is described, in which standard devices are used to measure the time intervals. Figures 3.

UDC 621.316.925

A STATISTICAL METHOD FOR CALCULATING THE DAMAGE TO AN ELECTRICAL SYSTEM BY FALSE RESPONSES OF REALY PROTECTION FOR POWER TRANSMISSION LINES

[Abstract of article by Karinskiy, Yu.I.]

[Text] A method is described for calculating the damage to an electrical system due to excessive actuation and failures in the actuation of the relay protection for the electrical power transmission lines as applied to the problem of optimizing the settings of the measurement devices for remote and current protection circuitry. This damage depends on the increase in the probabilities of a disruption of the power supply to system consumers because of the false reactions of relay protection, taking into account preventive maintenance and post-breakdown repairs to the lines and equipment of substations as well as the cost of a disruption in the electrical power supply for each consumer, taking into account violations in the production process, rejects and insufficient product output. Figures 3; tables 3; references 7.

UDC 621.316.925

ON THE QUESTION OF THE SENSITIVITY OF PROTECTION AGAINST SHORTS TO GROUNDS OF POWER GENERATION UNITS

[Abstract of article by Bogachenkov, A.Ye.]

[Text] The specific features of the design of various kinds of protection against short circuits to ground in the generators of power units are treated, as well as their sensitivity to various values of the resistance of the neutral circuit, and transient resistances at the point of the short to ground. Figures 3; tables 1; references 16.

UDC 621.316.92.00124

THE CALCULATION OF THE IMPACT OF OVERVOLTAGES ON LIMITERS IN NETWORKS WITH AN INSULATED NEUTRAL

[Abstract of article by Samoylovich, I.S.]

[Text] A technique is presented for the statistical calculation of the effect of overvoltages on limiters in networks with an isolated neutral. The functions and parameters of the distribution of the major characteristics of the discharge current are determined, where there are data on the distribution of the over-voltage levels and the network parameters. Figures 3; tables 2; references 2.

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CSO: 1860/217

CERTAIN ASPECTS OF PHOTOGRAPHY, MOTION PICTURES AND TELEVISION

UDC 621.385.832.564.4

PHOTOELECTRIC CHARACTERISTICS OF THE LI459 VIDICON

Moscow TEKHNIKA KINO I TELEVIDENIYA in Russian No 1, Jan 81 pp 43-46

[Article by A.Ye. Gershberg, N.N. Mikhaylov-Teplov, S.P. Nizhegorodov and Yu.V. Savel'yev]

[Text] The development of vidicons with targets based on cadmium selenide (cadmicons or halnicons) has substantially improved vidicon parameters. The sensitivity and signal uniformity over the image field have been increased, while the response lag and dark currents have been reduced. Along with this, the linearity of the rise in the photoelectric current, which is inherent in vidicons with such targets, has brought about a rapid rise in the charge accumulated on the target with the presence of illumination. Since the current of the commutated beam must be limited to assure high resolution of the device, the light range of the vidicon proves to be narrow. This circumstance forces increased complexity on the transmitting camera design through the introduction of light controlling devices. For this reason, it was desirable to design a vidicon which has the advantages of vidicons with cadmium selenide targets, the light characteristic of which would be nonlinear in a definite range ($\gamma < 1$). The latter would provide for a slower rise in the charge accumulated on the target as a function of the light and a correspondingly wider light characteristic.

The LI459 vidicon is the first vidicon with a cadmium selenide target having an expanded light range. This is a half-inch vidicon with mixed beam control (electrostatic focusing and magnetic deflection), which is similar in terms of its structural design to the LI437 and LI448 vidicons, differing from the LI430 and LI453 vidicons only in the structural design of the grid positioned at the target. The parameters of the device are checked for a working target surface of 4.9 x 6.5 mm^2, and a target illumination of 1 lux (a type "A" source) with standard TV resolution. Under such conditions, the vidicon provides for a signal current of no less than 0.1 μA, a dark current of no more than 5 nA, a resolving power at the center of no less than 500 lines, and no less than 400 lines at the corners, a residual signal 40 msec after the light is cut off of no more than 20% and a signal nonuniformity over the raster of no more than 15%. The set of parameters indicated here, as well as the spectral response, are extremely close to the parameters of cadmium selenide target vidicons (for example, the LI448). The difference consists in a slight increase in the sensitivity and the response lag. However, the light range of the latter is quite limited (for example, the minimum range of the LI448 is 3 lux). The LI459 vidicon is likewise tested at an illumination of 500 lux, at which it should provide a signal current of no less than 0.1 μA and have a resolution of no less than 500 lines.

Along with this, the parameters cited do not contain any information on the properties of the vidicons for illuminations in a range of 1 to 500 lux. Obtaining data on the properties of the devices throughout the entire range of illumination variation was the major task of this paper.

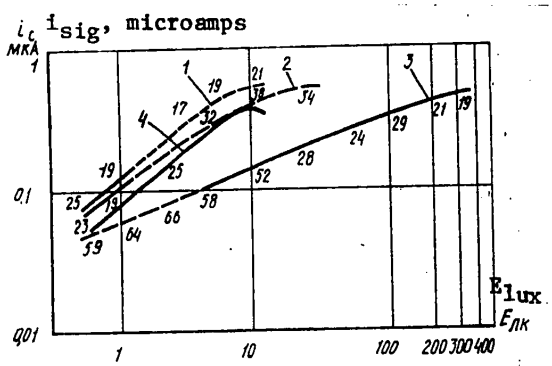

Figure 1.

The light characteristics of one sample of a LI459 vidicon. The numbers designate the residual signal after 40 msec. The regions of rise in the residual signal with illumination are shown by the dashed lines, while the regions of decay are shown by the solid lines.

U_{sp}:
1. 30 volts;
2. 20 volts;
3. 10 volts;
4. The light characteristic of a cadmicon.

The light characteristics of one of the devices, which are shown in Figure 1, were measured using a slot in an opaque diaphragm. This provided for signal measurement in accordance with its definition as the difference in the currents at the black-white transition. Such a test pattern corresponds to natural subjects with a small illuminated area. The light characteristics were recorded for several values of the signal plate potential [U_{sp}]. In this case, the greatest value of U_{sp} corresponded to the optimal alignment for an illumination of 1 lux. At this light level and the maximum U_{sp}, γ was close to unity. The light range for such values of U_{sp} is 1 to 10 lux (depending on the specific value of U_{sp} and the properties of the sample). With an increase in the illumination and a reduction in U_{sp}, the value of γ falls off. Thus, at the maximum U_{sp}, the light characteristic is linear for low level illumination, and for high illumination, it is nonlinear. The light characteristic in cadmicons (see Figure 1) is linear under similar conditions practically to the point of image blooming, caused by insufficient beam current. At low values of U_{sp} and for signals which are not very small, the entire light characteristic is nonlinear. The appearance of nonlinearity provides for an expansion of the light range for a specified beam current and a specified value of the signal plate potential.

It must be added that the curve for the light characteristic will depend on the ratio of the transparent and opaque regions in the diapositive of the test pattern, since a consequence of the high target sensitivity is that a small fraction of the incident light which has passed through the target and is then reflected back to the target, substantially increases the dark current. For this reason, when a test pattern with considerably transparency is employed, the signal currents are lower and the light characteristic can change over from an increasing one to a falling characteristic, reducing the light range.

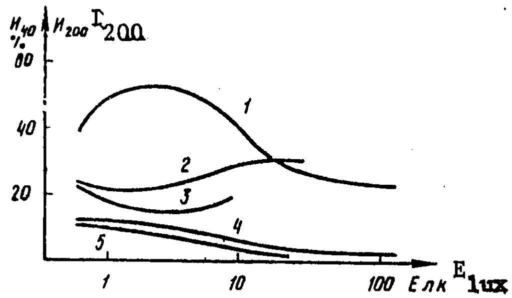

Figure 2. The change in the residual signal (I_{40}, %; I_{200}, %) in various regions of the light characteristic for one of the LI459 vidicons.

Key: I_{40}: 1. U_{sp} = 10 v;
2. U_{sp} = 20 v;
3. U_{sp} = 30 v, 40 v;

I_{200}: 4. U_{sp} = 10 v;
5. U_{sp} = 20 v, 30 v, 40 v.

TABLE 1.

Parameter (Параметр)	Sample 3 (Образец 3)				Sample 4 (Образец 4)			
i_c, мкА µA	0,1	0,2	0,3	0,1	0,2	0,3	0,4	0,5
I_{40} $И_{40}$, %	30	40	47	30	33	36	38	50
I_k $И_к$, %	6	10	8,5	3	3,5	8	7,5	6

TABLE 2.

$i_{поясн}$ bias	i_{signal} i_c, мкА µA: 0,05	0,1	0,2	0,3	0,4	0,5
0	40	26	28	35	48	61
10 нА nA	40	26	28	35	48	61
20 нА nA	37	26	28	35	48	61

The lag (the residual signal 40 msec and 200 msec after the light is cut off) was measured at all points on the light characteristics of the vidicons. Three regions of residual signal levels are observed on individual light characteristics: with an increase in the illumination from the minimal value, the response lag decreased, and thereafter increased, for the most part up to very high values (in particular, above those shown in Figure 2); it then dropped off, sometimes down to values substantially below the initial values. Some of the light characteristics contain two (rarely one) of the indicated regions. The first region (the reduction in the inertial lag) is characteristic of all vidicons with photodiode targets and is explained by the reduction in the switching lag with an increase in the target potential, which corresponds to an increase in the illumination and the signal.

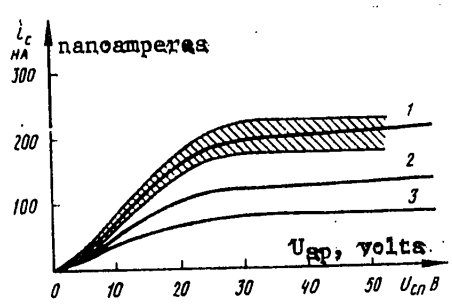

Figure 3. The volt-ampere characteristics of one of the LI459 samples.

Key: 1. E = 2 lux;
2. E = 1 lux;
3. E = 0.5 lux.

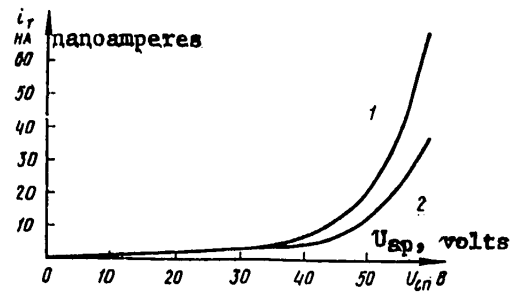

Figure 4. The dark current as a function of the voltage at the signal plate for two LI459 vidicon samples.

At reduced values of U_{sp}, the light characteristics now show $\gamma < 1$ in the initial section; in this case, with an increase in the illumination, not a reduction, but rather an increase in the response lag is observed. The sharp increase in the response lag as a function of the illumination at values of the latter above the control point is a specific feature of LI459 vidicons.

Measurements of the commutation component of the response lag (I_k) were made with special equipment for a number of samples. The results of the measurements are shown in Table 1 for samples 3 and 4.

It follows from these data that for LI459 vidicons, the commutation lag amounts to an insignificant part of the overall response lag. It follows from this that the application of external bias lighting of the target to reduce the response lag is not expedient in the given case, something which is also illustrated by the values of the response lag (I_{40}, %) which are shown in Table 2 (the bias lighting lag is characterized by the target current it produces: i_{bias}).

The small value of the commutation response lag is explained in turn by the relatively small target capacitance (about 500 pF).

Typical volt-ampere characteristics and the dark current as a function of the signal plate voltage are shown in Figures 3 and 4 for two samples.

The spectral characteristics of LI459 vidicons, measured using the adopted procedure with standard test equipment, agree with the spectral characteristics measured under the same conditions for vidicons with a cadmium selenide target. In the case of measurements under typical conditions, the signal current is small, something which is due to the low energy sampled by the monochromator in a narrow spectral range.

To check how much the spectral characteristic determines the properties of a tube in all operating modes, the spectral characteristics were measured with changes in U_{sp} and the signal (energy) level (Figure 5). With a reduction in U_{sp} and the signal, the sensitivity in the shortwave portion of the spectrum fell off for all of the tested vidicons, all the way down to total insensivity to the blue and green portions of the spectrum. The maximum of the characteristic is shifted from approximately 700 to 720 nm. The change in the spectral characteristic with an increase in the illumination is greatest in a certain range of light levels, which is different for various samples.

To quantitatively estimate target burn, the central region of the target of an LI459 vidicon was illuminated for 15 minutes at $i_s = 0.15$ μA at an illumination of 1 lux, 10 lux and 100 lux (the signal plate voltage was varied). The illumination was accomplished through a hole in an opaque diaphragm, after which it was taken out and the burn signal (negative polarity) was immediately measured for the

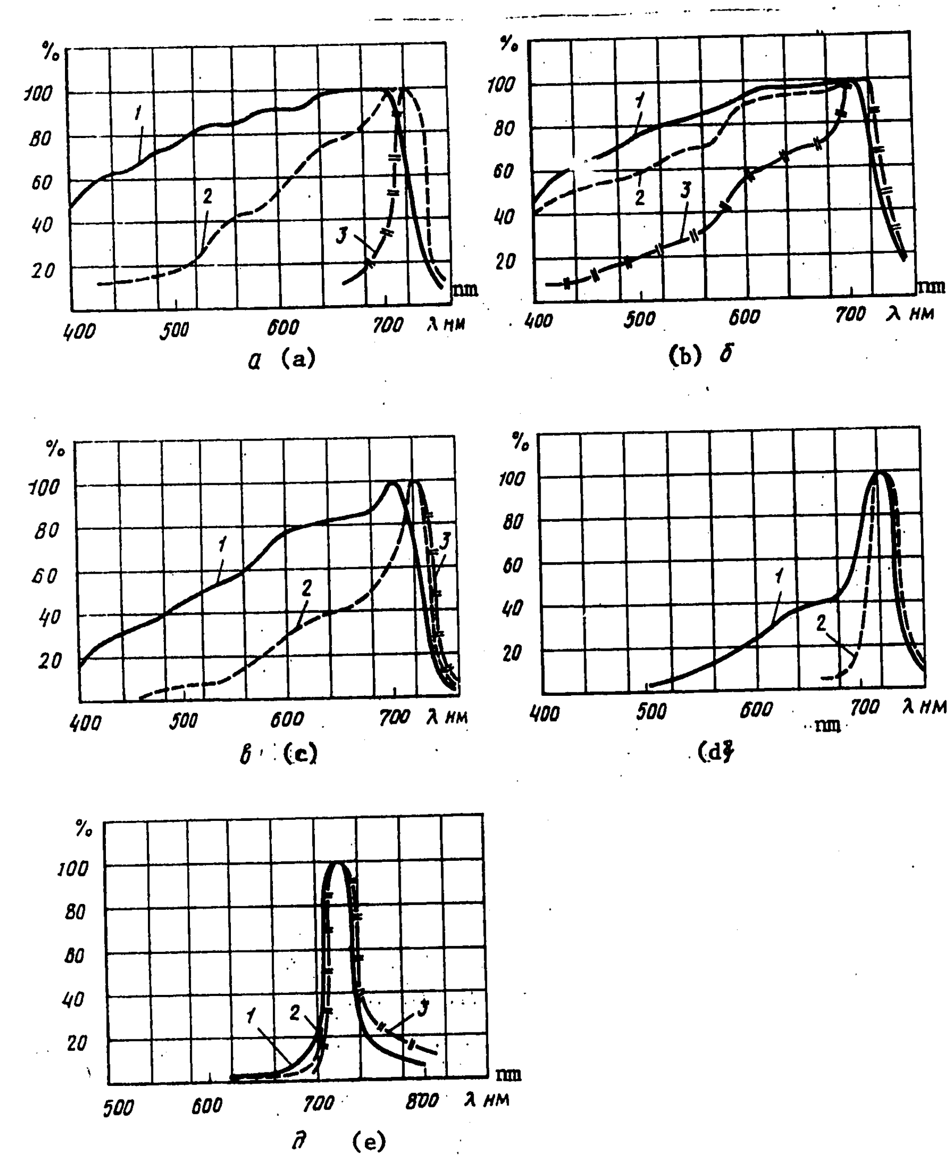

Figure 5. The spectral characteristics of one of the LI459 vidicon in various operating modes.

a. U_{sp} = 50 volts; i_s: 1. 30 nA; 2. 250 nA; 3. 500 nA;
b. U_{sp} = 40 volts; i_s: 1. 30 nA; 2. 90 nA; 3. 150 nA;
c. U_{sp} = 30 volts; i_s: 1. 30 nA; 2. 80 nA; 3. 200 nA;
d. U_{sp} = 20 volts; i_s: 1. 30 nA; 2. 70 nA;
e. U_{sp} = 10 volts; i_s: 1. 14 nA; 2. 17 nA; 3. 30 nA.

TABLE 3

Target Burn Mode, lux	Target Burn Signal (microamperes)	
	Sample 1	Sample 2
1	0.002	0.016
10	0.011	0.017
100	0.002	0.002

uniformly illuminated field. The results of the measurements using the procedure described above are presented in Table 3.

It must be added that the target burn in the given target is of a reversible nature: it disappears after a few hours.

The light range in ordinary cadmicons can also be expanded in a manner similar to that presented above through a reduction in the signal plate potential. However, the target burn effect is manifest sharply in this case. Moreover, with a reduction in the signal plate potential, the signal at the corners drops out earlier for cadmicons (the corners "bloom").

Conclusions

1. The LI459 vidicon makes it possible to operate with control of the voltage at the signal plate in a wide light range while retaining satisfactory light parameters. In the maximum sensitivity mode (with a constant U_{sp}) and with adjustment of the signal plate potential, it has a greater light range than a cadmicon.

2. It is most expedient to use the LI459 vidicon in simple applied black and white TV cameras, operating in a broad range without special light control devices. Because of the considerable change in the spectral characteristic as a function of the operating conditions, it cannot be used in color television cameras.

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COLOR TELEVISION VIDICONS WITH A LEAD OXIDE TARGET

Moscow TEKHNIKA KINO I TELEVIDENIYA in Russian No 1, Jan 81 pp 38-42

[Article by G.S. Vil'dgrube, M.A. Kalantarov, V.A. Kozlov, A. G. Lapuk and O.A. Timofeyev]

[Text] Vidicons with a lead oxide target (OSM) are the main type of transmitting tubes in use throughout the world for color television broadcasting [1]*. This is due to the following properties of vidicons with lead oxide targets:

--The relatively high sensitivity; the close match between the spectral sensitivity and the sight curve of the eye; the small scatter in the slope of the light characteristic from device to device; the low dark current level; the fast response; and the slight dependence of the parameters on temperature in a range of -3- to +50 °C.

The following type of lead oxide target vidicons are being series produced by domestic industry: LI432, LI442, LI460, LI462, LI457 and LI458. All of the devices have magnetic focusing and beam deflection. Some of the specific structural design features of the vidicons (Figure 1) are noted in Table 1.

The Lead Oxide Target

The good operational performance of vidicons is determined in many regards by the photoconductive target. It takes the form of a polycrystalline lead oxide film with a thickness of 12 to 20 micrometers, applied to a conducting

*Vidicons with lead oxide targets have company names abroad: Plumbicon ("Philips") and Leadicon ("English Electric").

transparent signal plate. The crystallites have a plate-light shape with dimensions of approximately 0.1 x 3 x 0.05 micrometers. The specific surface, determined by radioactive krypton adsorption, is 30 to 50 m^2/g. The film porosity is 50 to 60 percent.

The target on the substrate side consists predominantly of the rhombic modification of PbO, where the crystallites in the [010] plane are oriented parallel to the substrate. The remainder of the film is formed by tetragonal crystallites with the [110] plane oriented parallel to the substrate. The ratio of the amount of the tetragonal to the rhombic forms is approximately 9:1.

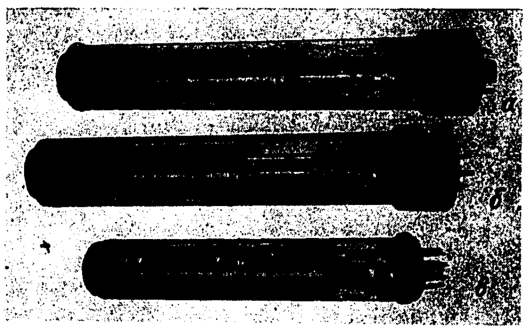

Figure 1.

An exterior view of the vidicons:
top: LI432, LI442;
center: LI460, LI462;
bottom: LI457, LI458.

The energy structure of the target is specified by the fact that an intermediate layer with n-type conductivity is formed alongside the signal plate, and then enters a region with quasinatural conductivity (i), forming the bulk of the target thickness; then, a region with p-type conductivity is created by means at the target surface by means of special processing.

With the working voltage polarity (positive at the signal plate), the n and p-type intermediate layer play the part of the blocking contacts, and the entire system behaves in a manner similar to a pin-photodiode, connected in the cutoff direction. Because of this, as well as because of the considerable width of the forbidden band of tetragonal lead oxide (1.9 eV), the dark current of the lead oxide target has an extremely small value. The dark current levels of vidicons, which fall in range of 0.5 to 3 nanoamperes, are due to scattered light and X-radiation, present inside the envelope of the device during the operation of its electron-optical system.

With a voltage of 45 V at the signal plate (the working voltage), a relatively high electrical field intensity is produced in the target, which provides for high efficiency in the separation of the electron-hole pairs generated by the light and the fast output of the charge barriers to the contact regions. At the working value of the voltage, the signal current is close to the saturated value, while the light-signal characteristic becomes close to a strictly linear response, and the slope of this characteristic amounts to 0.95 ± 0.05 for various devices, something which makes it possible to easily accomplish the balancing of the

TABLE 1. Specific Design Features of Lead Oxide Target Vidicons

Type of Device	Envelope Diameter (max), mm	Spectral Sensitivity Range, nm	Target Light Bias System	Size of the Working Target Area, mm^2	Type of Electron Gun
LI432	30.6	400 - 640	None	17.1 x 12.8	Triode
LI442	30.6	400 - 700	None	17.1 x 12.8	Triode
LI460	30.6	400 - 640	Yes	17.1 x 12.8	Triode
LI462	30.6	400 - 700	Yes	17.1 x 12.8	Triode
LI457	26.2	400 - 640	Yes	12.7 x 9.5	Tetrode "anticomet"
LI458	26.2	400 - 700	Yes	12.7 x 9.5	The same

chrominance signals in the transmitting cameras without preliminary selection of the tubes according to the light characteristic.

The fast output of charge carriers to the contact regions leads to a small photoelectric inertia, while the porosity of the targets and their considerable thickness is responsible for relatively small capacitances of the working region (400 to 600 pF/cm^2), and consequently, a reduction in the commutation component of the response inertia of the vidicons. Because of the combined effect of the factors indicated here, lead oxide target vidicons have the least response lag of the other types of vidicons.

The spectral characteristics of the vidicons are shown in Figure 2. The vidicons intended for operation in the blue channel have a characteristic which is shifted towards the shortwave end. All of the vidicons have a sensitivity maximum in a range of 450 - 525 nm. The quantum yield in this region figured on the basis of the absorbed light is close to unity. Beyond 550 nm, the sensitivity falls off rapidly; because of a reduction in the optical absorption in the lead oxide, the sensitivity practically disappears at 640 nm. This interferes with correct color transmission and in order to shift the red sensitivity boundary in the direction of longer wavelengths, sulfur is introduced into the target, which leads to the formation of oxysulfide compounds with lower photoelectric activation energies than for pure lead oxide. In this way, the red boundary is shifted and the sensitivity to red light is increased for the LI442, LI462 and LI458 vidicons.

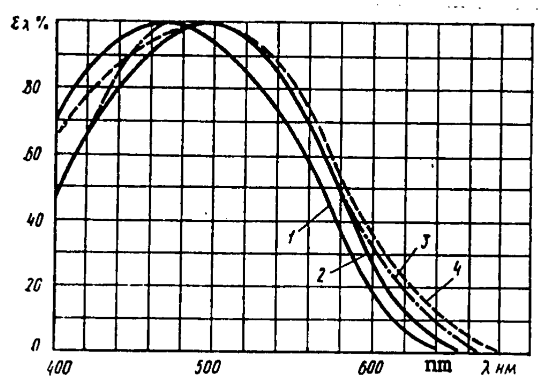

Figure 2. Vidicon spectral sensitivity characteristics.

Key:
1. For the blue channel, LI432 s, LI460 s, LI 457 s;
2. For the brightness, green and red channels, LI432 ya, z, k; LI 460 ya, z, k; LI457 ya, z, k;
3. LI458 ya, k [brightness, red channels];
4. LI442 ya, k; LI462 ya, k.

The Structural Design of Lead Oxide Target Vidicons

The specific features of the application of vidicons in multitube transmitting cameras place high requirements on the vidicons in terms of the value and identical nature of the geometric distortions. The scatter in the geometric distortions in a central region with a radius of 0.4h (where h is the image height) does not exceed 0.05%; in a region with a radius equal to half of the image width, it does not exceed 0.15% and in the remaining portion of the raster, does not exceed 0.3%. To meet these requirements, the envelopes of the vidicons are calibrated with respect to the inside diameters. The electron optics (EOS) are strictly centered relative to the envelope by means of two rigid clamps, made with small tolerances.

The position of the clamps can be seen in Figure 1. To reduce the scatter in the geometric distortions, the tolerances for the spacing between the grid and the target have been substantially reduced (as compared to other types of vidicons); using special assembly jigs, good coaxial alignment of the focusing electrode and the gun is achieved.

The rigid securing of the electron optics to the base seal and relative to the envelope, as well as the high resonant frequency for grid oscillations eliminate microphonics.

To reduce the response lag for LI460, LI462, LI457 and LI458 vidicons, internal bias lighting of the target is employed, which increases the signal readout efficiency for weakly illuminated portions of the image. In the first two vidicons, bias lighting is accomplished through a hole in the focusing electrode from an illuminator located outside the tube on its basing socket, and connected in parallel with the thermionic cathode heater. The bias lighting intensity is adjusted with a diaphragm placed in the illuminator.

In the LI457 and LI458 vidicons, the target is bias lighted by a lightguide with two outputs, arranged symmetrically inside the focusing electrode. The input end of the lightguide is sealed into the exhaust stem of the tube. The illuminating lamp is mounted in the vidicon power socket; the bias lighting intensity is adjusted by varying the voltage to the lamp.

TABLE 2 The Electrical Specifications for Lead Oxide Target Vidicons

	LI432 LI442	LI460 LI462	LI457 LI458
Filament voltage, volts	6.3	6.3	6.3
Filament current without the illuminator, ma	300	300	90
Illuminator current, ma	-	80	80
Voltage at the first anode, volts	300	300	300
Voltage at the supplemental electrode, volts	-	-	300
Voltage at the second anode, volts	600	600	500
Grid voltage, volts	675	675	750

The internal surface of the focusing electrodes of all vidicons is given a matte finish to improve the target bias lighting uniformity. The nonuniformity in the target current, produced by the bias lighting, is symmetrical relative to the center of the target and does not exceed 15%.

Because of the increased diffuse scattering of light at lead oxide targets, all of the vidicons have anti-halo discs secured to the input window with an optical glue.

TABLE 3. The Sensitivity and Modulation Level of Lead Oxide Target Vidicons

Parameter Designation	LI432ya LI460ya	LI432s LI460s	LI432z LI460z	LI432k LI460k	LI442ya LI462ya	LI442k LI462k	LI457ya	LI457z	LI457s	LI457k	LI458ya	LI458k
Sensitivity, μA/lm:												
minimal	360	40	140	100	450	160	360	130	40	75	400	115
typical	400	53	156	125	500	185	400	150	44	85	-	130
Modulation level of the signal current in %:												
minimal	40	45	40	35	55	40	40	40	45	35	45	40
typical	44	56	50	42	60	50	44	44	50	-	-	45

[Suffixes break out as follows: "ya" = brightness; "s" = blue; "z" = green; "k" = red]

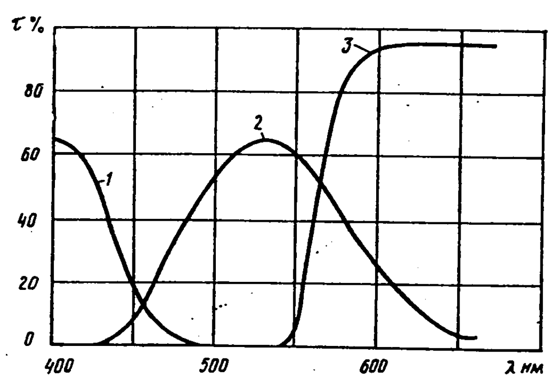

Figure 3.

The spectral light transmittance characteristics of the filters:

1. SS4 (2 mm thick);
2. ZhZS-9 (3 mm thick);
3. OS13 (5 mm thick).

For vidicons with increased red sensitivity, an interference light filter with a primary passband in the 400 to 720 nm range is applied to the anti-halo disc to suppress the unnecessary sensitivity to light at a wavelength greater than 720 nm.

One of the special structural design features of the LI457 and LI458 vidicons is the "anticomet" (AK) tetrode type gun, which is distinguiahsed by an additional electrode in the cavity of the first anode.

During the beam retrace, when the horizontal line voltage pulses are being fed to the additional electrode, the modulator and the cathode accomplish the additional charging of the overilluminated (with an exposure of 200 - 300 lux) portions of the target with an increased beam current (100 - 150 microamperes), something which assures the transmission of the moving overilluminated portions of the image without characteristic defects in the form of trails resembling taffy pulls ("comet tails"). The action of the anticomet gun has been described in greater detail in [2].

A second special design feature of the LI457 and LI458 vidicons is the ceramic support ring with two local leads of the signal plate which are glued to the disc of the envelope. Such a structural design cuts the output capacitance of the vidicons by more than half (2.5 to 3 pF), which reduces the camera preamplifier noise.

The high precision in gluing the support ring with a coaxial misalignment of no more than 100 micrometers relative to the grid assembly provides for high precision in combining the vidicon rasters in multiple tube cameras.

Electrical Specifications, Major Light Performance Parameters and Characteristics

The overall size and connection dimensions of the LI432, LI442, LI460 and LI462 vidicons are the same. The LI457 and LI458 vidicons likewise have identical overall and connector dimensions. The electrical operating conditions of the devices are given in Table 2.

The sensitivity of lead oxide target vidicons (Table 3), because of the linearity of the light response, is constant in the working range of illuminations and is governed by the signal current level, referenced to the light flux falling on the target. The sensitivity is measured for the case of target illumination by a source with a color temperature of 2,850° K. When measuring the sensitivity of vidicons intended for chrominance channels, color filters are inserted in the path of the incident light: the SS-4 is for the blue channel, the ZhZS-9 is for the green and OS-13 is for the red channel. The transmittance characteristics of the light filters are shown in Figure 3.

The resolving power of lead oxide target vidicons exceeds 600 lines. The modulation level is determined at the 400 line mark (5 MHz) for the case of optimal focusing in the image field and a uniform frequency response of the measurement channel. The measurement of the modulation level and all of the other parameters, with the exception of the sensitivity is made for a modulator voltage which provides for the following signal readout:

0.6 μA: for the LI432 ya, LI442 ya, LI460 ya, LI462 ya;
0.4 μA: for the LI457 ya, LI457 z, LI458 z;
0.3 μA: for the LI432 s, LI432 z, LI432 k, LI442 k, LI460 ya;
0.2 μA: for the LI457 s, LI457 k, LI458 k.

The values obtained under the indicated conditions are given in Table 3.

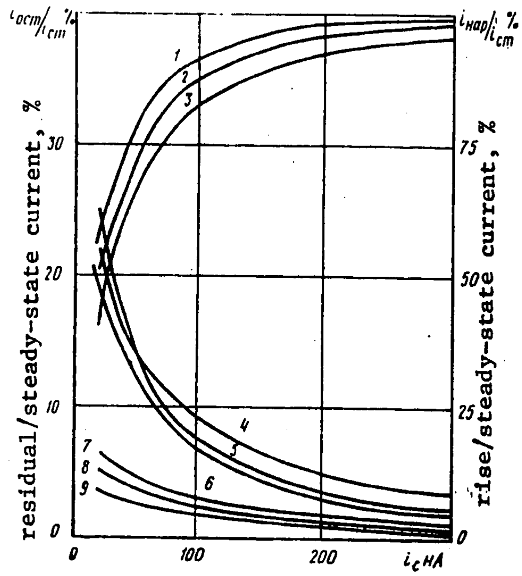

Figure 4. The signal rise and decay response lag.

Key: 1. Rise (40 msec), LI432 s;
2. Rise (40 msec), LI442 ya, k;
3. Rise (40 msec), LI432 ya, z, k;
4. Decay (40 msec), LI442 ya, k;
5. Decay (40 msec), LI432 s;
6. Decay (40 msec), LI432 ya, z, k;
7. Decay (200 msec), LI432 s;
8. Decay (200 msec), LI442 ya, k;
9. Decay (200 msec), LI432 ya, z, k.

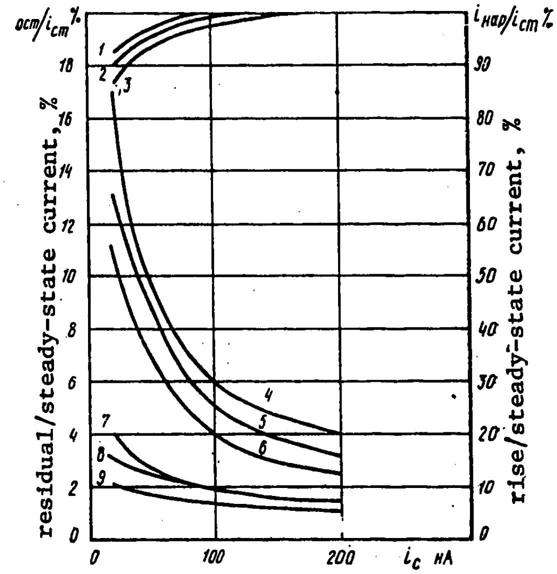

Figure 5. The signal rise and decay response lag

Key: 1. Rise (40 msec), LI457 ya, z;
2. Rise (40 msec), LI458 ya, z, k;
3. Rise (40 msec), LI457 s;
4. Decay (40 msec), LI458 ya, k;
5. Decay (40 msec), LI457 s;
6. Decay (40 msec), LI457 ya, z, k;
7. Decay (200 msec), LI458 ya, k;
8. Decay (200 msec), LI457 s;
9. Decay (200 msec), LI457 ya, z, k.

All of the vidicons can operate at beam currents sufficient to read out signals down to 1.2 μA, however, somewhat of a degradation in the modulation level and an increase in the geometric distortions as compared to the nominal beam current, are possible in this case.

As can be seen from Table 3, the modulation level is higher for vidicons for the blue channel and vidicons which have an increased sensitivity in the red portion of the spectrum. This is due to the fact that for lead oxide target vidicons, the factors which limit the resolving power are the light scattering in the target and the spreading out of the potential relief on the commutated surface of the target. In the case of illumination with blue light, the scattering is small because of the strong absorption. For the LI442, LI462 and LI458 vidicons, the modulation level is greater because of the increase in the surface resistance of the target caused by the introduction of sulfur.

The most important parameter of vidicons is the response lag. For lead oxide target vidicons, the response lag for the signal rise and decay is governed, just as for other vidicons, by the ratio of the signal generated after a definite time has elapsed following the illumination being turned on or off to the steady-state value of the signal. This ratio is usually expressed in percent and is defined at 40 msec and 200 msec intervals, i.e., after the fourth or fifth frame following the change in illumination.

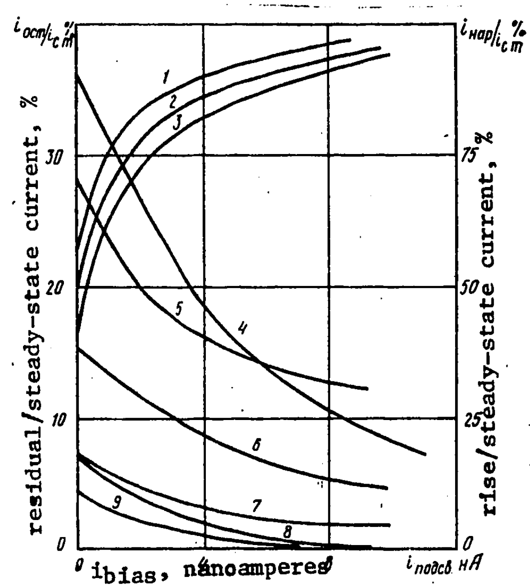

Figure 6. The response lag in the rise and decay as a function of the current produced by the bias lighting.

Key:
1. Rise (40 msec), LI460 ya, z, k;
2. Rise (40 msec), LI460 s;
3. Rise (40 msec), LI462 ya;
4. Decay (40 msec), LI462 ya, k;
5. Decay (40 msec), LI460 s;
6. Decay (40 msec), LI460 ya, z, k;
7. Decay (200 msec), LI460 s;
8. Decay (200 msec), LI460 s;
9. Decay (200 msec), LI460 ya, z, k.

The curves for the signal response rise and decay lag as a function of the signal current level are shown in Figures 4 and 5. The lower values of the response lag for equal signal currents for the LI457 and LI458 vidicons, as compared to the LI432, LI442, LI460 and LI462 are due to the lesser capacitance of the working target surface.

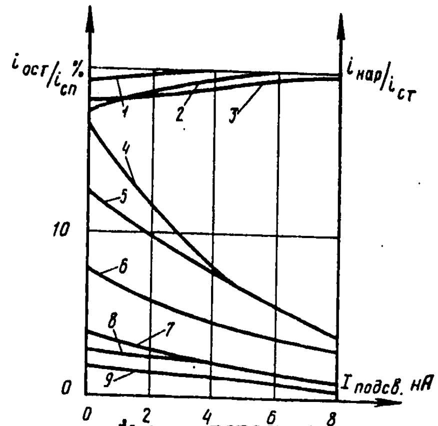

Figure 7. The response lag in the decay and rise as a function of the current produced by the bias lighting.

Key:
1. Rise (40 msec, 40 nA), LI457 ya, z;
2. Rise (40 msec, 20 nA), LI457 s;
3. Rise (40 msec, 20 nA), LI458 ya, k;
4. Decay (40 msec, 20 nA), LI458 ya, k;
5. Decay (40 msec, 20 nA), LI457 s;
6. Decay (40 msec, 40 nA), LI457 ya, z;
7. Decay (200 msec, 20 nA), LI458 ya, k;
8. Decay (200 msec, 20 nA), LI457 s;
9. Decay (200 msec, 40 nA), LI457 ya, z;

The curves for the signal current rise and decay lag are shown in Figures 5 and 6 as a function of the current produced by the bias lighting.

A substantial reduction in the lag occurs with an increase in the current produced by the bias lighting up to 5 nA (Figure 7). However, when cameras operate in reduced light, it is possible to increase the bias lighting intensity up to 8 - 10 nA in blue and red channel vidicons, where the lag is most pronounced. The bias lighting current nonuniformity does not exceed 15% in this case.

Conclusion

Two years of operational experience with the 30 mm diameter vidicons at 45 of the nation's television centers have demonstrated that the devices meet all of the modern requirements for color TV broadcasting during operation in three and four tube cameras.

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8225
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COMMUNICATIONS, COMMUNICATION EQUIPMENT, RECEIVERS AND TRANSMITTERS, NETWORKS, RADIO PHYSICS, DATA TRANSMISSION AND PROCESSING, INFORMATION THEORY

UDC 621.395.7

EVALUATION OF THE OVERALL LOSS OF TRUNKING CIRCUITS AND RECORDING CIRCUITS OF MUNICIPAL TELEPHONE NETWORKS

Moscow ELEKTROSVYAZ' in Russian No 11, Nov 80 pp 27-29

[Article by L. V. Andreyeva, M. Ya. Kaller, Yu. I. Kopacheva, Yu. A. Parfenov, and E. I. Sankovskiy, submitted 4 Jun 1979]

[Text] The automation of transmission processes of intercity telephone messages, introduction of crossbar ATS [automatic telephone exchanges] in local telephone networks, creation of multichannel transmission systems, cables of new types, and, at the same time, retention of the existing technical equipment, for example, coil-loaded circuits, made it necessary to evaluate telephone channels more precisely from the viewpoint of ensuring the quality of telephone communications and the possibility of transmitting service information by a multifrequency code via trunking circuits (SL) and recording circuits (ZSL) at the municipal telephone network.

This article gives the basic principles for evaluating overall attenuation of composite SL and ZSL which include low-frequency cables, KRR [cable radio relay] (KAMA) and IKM-30 transmission systems, bridge-type amplifiers, coil-loaded cables, and station quadripoles of various ATS with consideration for the mismatching of input resistances of the channel elements.

Methods of Constructing SL and ZSL and Their Elements. As is known, city telephone networks, with respect to their structure, are divided into single-office and multi-office networks, and the latter -- into networks with toll-switching planning and networks without toll-switching planning. The connection between rayon ATS (RATS), RATS and junction center ATS -- points of incoming messages (UVS) and points of outgoing messages (UIS), as well as between UVS and UIS, is accomplished through trunking circuits.

Automatic long-distance communication of subscribers of RATS with AMTS is accomplished through recording circuits, and in the opposite direction from AMTS to RATS -- through connecting lines of the long-distance trunk (SLM).

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The following two types of ATS are introduced widely in municipal telephone networks of our country: ten-step-system ATS (ATS-DSh) and crossbar-type ATS (ATSK). In order to ensure automatic long-distance communication, domestic and foreign crossbar AMTS [automatic long-distance telephone exchanges] are introduced. The matching of the interaction of switching devices of various systems of ATS and AMTS is achieved by using sets of trunk line relays (RSL).

During the stage of establishing the connection of subscribers included in an ATS-DSh, the digital information of dialing and other interaction signals are transmitted through the SL by direct-current pulses, and in the case of the ATSK -- by a "2 out of 6" multifrequency code, i.e., pulses of two different frequencies out of six provided for in the code are delivered simultaneously into the line. Two-frequency signals arrive at the SL input from a multifrequency generator of the ATSK equipment. The output level of the signal is 7.4 dB. The working frequencies of the code are: 0.7, 0.9, 1.1, 1.3, 1.5 and 1.7 kHz. The same frequencies are used for transmitting signals of the equipment of automatic number identification (AON).

Digital information of the interaction signals between ATS and AMTS is transmitted through SLM and ZSL either by the multifrequency method of the above-mentioned frequencies, or with direct-current pulses by the decade method, depending on the type of the interacting ATS and AMTS [automatic long-distance telephone exchange].

In the speech channel, after establishing the connection via SL, ZSL and SLM, telephone information is transmitted in the analog form (frequency spectrum 0.3-3.4 kHz).

At an automatically switching city telephone network, composite sections of SL, ZSL, and SLM channels are formed by connecting several different elements: physical (non-multiplexed) cable lines; cable lines equipped with amplifiers; coil-loaded lines; channels of frequency and digital transmission systems; switching devices of junction ATS with interoffice connecting cables. In the designing of SL and ZSL (SLM), the choice of elements is determined by the necessity of ensuring the attenuation norms.

TG or TPP-type cables with cores 0.5 and 0.7 mm in diameter are used as physical cable lines for SL and ZSL (SLM). Their individual sections are equipped with UMT [bridge amplifiers] or are coil-loaded. In some instances, TZ-type cables with cores of 0.8 and 0.9 mm are introduced.

Trunk lines are organized through four-wire TCh [tone frequency] channels with the aid of KRR or KAMA transmission systems and matching equipment -- special multiplex trunk line relays (RSLU).

There are several types of RSLU used in SL and ZSL, depending on the type of the telephone exchange (ATS-DSh, ATSK, or AMTS), type of service (local or long distance), purposes of the sets (incoming or outgoing). Each set, regardless of its type, in addition to a relay, contains attenuators and differential systems included in the speech channel which determine the overall loss of the SL.

SL sections which have multichannel transmission systems can have a two or four-wire termination. For composite SL and ZSL (SLM) channels which include sections of coil-loaded and noncoil-loaded physical cable circuits equipped with amplifiers (for uniform or mixed connection of the above-mentioned elements), the test jacks of the SL distributing frames of RATS should be considered as an input or output. A composite SL, ZSL (SLM) formed by TCh channels of the KPP equipment has an input and output on two-wire differential systems (DS) located at terminal RATS.

Requirements for the Overall Loss of SL and ZSL Transmission Channels. These requirements are established on the basis of the condition of ensuring normal functioning of the speech channel in the spectrum of frequencies of 0.3-3.4 kHz. For the system of Statewide Automatically Switching Telephone Network (OAKTS), attenuation is distributed over the sections of the long-distance and local speech channel.

Table 1

(1) Назначение связи	(4) Участок тракта соединительных линий	(10) Рабочее затухание, дБ	
		(11) по физическим кабельным цепям	(12) по каналам систем передачи
АТС—АТС (2)	РАТС—УВС (УИС) (5)	13,0	7,0
	УВС—УИС (6)	9,0	7,0
	РАТС—УВС—УИС—РАТС (7)	18,0	—
АТС—МТС (3)	РАТС—АМТС (8)	4,0	4,0
	АМТС—РАТС (9)	4,0	4,0

Key: 1. Purpose of service
2. ATS - ATS
3. ATS - MTS
4. Route section of connecting lines
5. RATS - UVS (UIS)
6. UVS - UIS
7. RATS - UVS - UIS - RATS
8. RATS - AMTS
9. AMTS - RATS
10. Overall loss, dB
11. Along physical cable networks
12. Along channels of transmission systems

Table 1 shows normalized maximum values of the overall loss at a frequency of 0.8 kHz for SL, ZSL, and SLM.

In order to ensure stable transmission of interaction signals on frequencies of 0.7, 0.9, 1.1, 1.3, 1.5, and 1.7 kHz, there are additional requirements with respect to the overall loss for SL and ZSL (SLM) channels of the city telephone network which depend on the technical characteristics of code receivers.

A code receiver must normally work: through noncoil-loaded cable lines at a relatively lower level of the upper transmitted frequency by not over 4.3 dB when adjacent frequencies are transmitted, and by not over 10.4 dB in transmitting extreme frequencies used (0.7 and 1.7 kHz); through coil-loaded cable lines at a relatively low level of the lower transmitted frequency of not more than by 2.6 dB during the transmission of adjacent frequencies and not more than by 3.5 dB during the transmission of frequencies of 0.7 and 1.3 kHz.

Initial Data for Evaluating the Overall Loss of SL and ZSL Channels. In evaluating the overall loss of a section of a channel equipped with bridge-type amplifiers, their characteristic impedance Z_x on all frequencies is taken to be equal to the wave impedance Z_w of the cable circuit to which the amplifier is connected. Therefore, the changes in the operative attenuation of the amplifier-line joint are not taken into consideration in calculations. The value of the net loss of the section of the line with the amplifier is taken as the attenuation of the composite channel a.

The characteristic impedence of the section of the channel containing the KRR (KAMA) and IKM-30 equipment is established to be equal to 600 ohms. The image attenuation of the TCh channel of multichannel transmission systems is taken to be equal to its overall attenuation on all frequencies.

Table 2

Частота, кГц (1)	Параметры передачи станционного четырехполюсника (2)		
	$\|Z_x\|$, Ом (3)	φ_x, град (4)	a, дБ (5)
		АТСК (6)	
0,7	1243/957	+6.0/—14,16	0,60/0.65
0,8	1232/965	+17,15/—15,25	0,56/0.62
0,9	1198/975	+13,00/—17,00	0,55/0,59
1,1	990/960	+1,50/—17,25	0,53/0.55
1,3	800/907	—3,50/—12,50	0,55/0,52
1,5	675/850	—10,25/—7,50	0,58/0,50
1,7	583/790	—14,25/—3,00	0,61/0,48
		АТС-ДШ (7)	
0,7	923/810/700	—50,00/—2,50/—58,50	1,44/0,77/0,41
0,8	864/807/646	—62,75/—4,00/—57,00	1,36/0,74/0,44
0.9	760/800/595	—62,30/—2,75/—55,50	1,31/0,75/0,46
1,1	667/750/527	—60,30/—4,50/—53,50	1,23/0,77/0,45
1,3	627/700/483	—59,50/—19,00/—52,00	1,21/0,50/0,50
1,5	595/656/447	—58,00/—34,50/—50,75	1,21/0,82/0,52
1,7	561/615/416	—57,00/—46,50/—50,00	1,23/0,84/0,54

Note. First figure -- value for incoming connection, second figure -- for outgoing connection, third figure -- for tandem connection.

Key:
1. Frequency, kHz
2. Transmission parameters of a station quadripole
3. Ohms
4. Degrees
5. Decibels
6. ATSK
7. ATS - DSh

The electrical characteristics of the channel elements, station quadripoles of ATS, and cable circuits are shown in Tables 2-3.

Fundamentals of the Method of Evaluating the Overall Loss of SL and ZSL Channels. SL and ZSL are composite channels whose connected elements are cable circuits, switching devices of ATS, UMT-type low-frequency amplifiers, and channels of transmission systems.

Table 3

Тип кабеля (1)	Обозначение параметра, единица измерения (8)	(13) Значение параметра на частоте, кГц 0,7	0,8	0,9	1,1	1,3	1,5	1,7
ТГ-0,5 (2)	α, дБ/км (9)	1,14	[illegible]	1,26	1,40	1,52	1,63	1,75
	β, рад/км (10)	0,130	0,140	0,148	0,162	0,174	0,185	0,196
	$Z_в$, Ом (11)	890	830	765	715	660	620	588
	$φ_в$, град (12)	−44,7	−44,63	−44,58	−44,4	−44,25	−44,10	−43,85
ТГ-0,7 (3)	α, дБ/км	0,88	0,95	1,00	1,09	1,14	1,19	1,23
	β, рад/км	0,100	0,110	0,114	0,129	0,134	0,141	0,148
	$Z_в$, Ом	715	672	630	570	535	500	480
	$φ_в$, град	−44,10	−44,00	−43,85	−43,55	−43,28	−43,00	−42,70
ТПП-0,5 (4)	α, дБ/км	1,11	1,17	1,24	1,38	1,50	1,61	1,72
	β, рад/км	0,128	0,135	0,142	0,158	0,174	0,185	0,200
	$Z_в$, Ом	975	917	865	775	700	650	625
	$φ_в$, град	−44,55	−44,50	−44,40	−44,28	−44,13	−43,93	−43,72
ТПП-0,7 (5)	α, дБ/км	0,76	0,82	0,87	0,96	1,02	1,09	1,15
	β, рад/км	0,088	0,094	0,100	0,110	0,120	0,130	0,140
	$Z_в$, Ом	724	676	639	578	530	500	485
	$φ_в$, град	−44,08	−43,93	−43,85	−43,55	−43,30	−43,03	−42,75
ТЗ-0,8 (6)	α, дБ/км	0,58	0,62	0,66	0,73	0,78	0,83	0,88
	β, рад/км	0,067	0,071	0,076	0,084	0,091	0,103	0,110
	$Z_в$, Ом	698	553	616	557	513	460	460
	$φ_в$, град	−43,80	−43,30	−42,99	−42,05	−41,20	−40,35	−39,50
ТЗ-0,9 (7)	α, дБ/км	0,51	0,54	0,57	0,63	0,68	0,71	0,74
	β, рад/км	0,058	[illegible]	0,066	0,073	0,080	0,089	0,095
	$Z_в$, Ом	641	600	566	512	465	430	410
	$φ_в$, град	−43,00	−42,85	−42,50	−42,00	−41,55	−41,00	−40,5

Key:
1. Type of cable
2. TG-0.5
3. TG-0.7
4. TPP-0.5
5. TPP-0.7
6. TZ-0.8
7. TZ-0.9
8. Designation of parameter, unit of measurement
9. dB/km
10. rad/km
11. ohms
12. degree
13. Parameter value on frequency,kHz

The frequency dependence of the overall attenuation of SL and ZSL not containing coil-loaded cables is uniform within the frequency range 0.7-1.7 kHz. For lines formed by physical circuits, attenuation grows in proportion to $\sqrt{f}$, and for lines containing UMT amplifiers or a transmission system, it practically does not depend on the frequency.

The increment of the channel attenuation due to mismatching of the input resistance depends little on the frequency in the frequency range of the interaction signals and has negative values. Therefore, the evaluation of the overall loss of SL and ZSL (SLM) composed of physical circuits of noncoil-loaded cables, UMT amplifiers and TCh channels formed by KPP equipment is done by simple summation of intrinsic losses on a frequency of 0.8 kHz, which ensures the fulfillment of the norms over the entire operating frequency range (0.7-1.7 kHz).

In the case of composite channels containing coil-loaded cables, the increment of channel attenuation due to the mismatching of input resistance changes in a wavelike manner with frequency and can be positive. Due to this, the evaluation of the overall losses of such channels is done on a frequency of 0.8 kHz on which the attenuation of the speech channel is monitored, and on the operating frequencies of code receivers (0.7, 0.9, 1.1, 1.3, 1.5, 1.7 kHz).

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CSO: 8144/0897

UDC 621.395.44:621.315.212

LINE CIRCUIT EQUIPMENT OF THE K-1920P TRANSMISSION SYSTEM

Moscow ELEKTROSVYAZ' in Russian No 1, Nov 80 pp 6-11

[Article by N. Ye. Lugovskoy and G. N. Stepanov, submitted 1 Aug 1979]

[Text] The development and state tests of the domestic transistorized transmission system K-1920P have been completed. This equipment is intended for use in new main cable communication lines and for replacement of the operating tube equipment K-1920 for the purpose of raising technical and economic indexes of circuits and channels. The length of the repeater section remains the same -- 6 km. One of the main advantages of the new equipment is a longer distance (240 km) between attended repeater stations, which makes it possible to use manpower resources economically in operating the primary communication network. The K-1920P operates with the standardized terminal equipment with frequency division of channels OKOP and with terminal television equipment. The new transmission system satisfies the YeASS [Unified Automated Network of the Soviet Union] standards with respect to its basic parameters. Its series production has been started.

Composition and Purpose of the Equipment. The line circuit set K-1920P contains all types of equipment necessary for normal operation of main lines. This set includes: high-frequency equipment of the line circuit, including equipment for the line circuit of the distribution system K-24R and the remote power supply unit (DP); equipment for the link between operators (SS); telemechanics equipment (TM); equipment for the introduction, switching, and branching of television channels (TV); phase correction device, device for introducing a cable into NUP [unattended repeater station]; auxiliary equipment -- monitoring equipment, connecting lines with the television center, bay of DP filter for attended stations, device for checking DP circuits, and the telephone of the patrol lineman.

The K-1920P also includes the following: equipment for coupling the line circuit with the terminal conversion equipment OKOP [2] and television equipment [3]; equipment for isolating from the line frequency spectrum two lower in spectrum 60-channel groups of conversion of the video spectrum of television and sound signals into the line frequency spectrum.

High-frequency equipment of the line circuit is intended to work through coaxial cables with pairs of the normal diameter of 2.6/9.4 mm (chiefly through the KMB-4 cable). The use of the KMB-8/6 cable appears to be unlikely. However, if in some concrete case this proves to be practical, it is possible to use the K-300R working through 1.2/4.6 mm coaxial pairs.

Variants of the uses of the line spectrum of frequencies in the K-1920P transmission system are shown in Figure 1. The first variant corresponds to the organization of standard TCh [tone frequency] channels and group channels; the second variant shows the organization of 300 TCh channels, TV channels and sound channels (ZS); the third variant shows the organization of 120 TCh channels, a TV channel and three broadcasting channels one of which is intended for ZS.

It is evident that the second variant would be used chiefly in the reconstruction of old main lines when it is impossible to reduce the number of TCh channels, and the third variant will be used in the construction of new main lines for simplifying the organization of tandem operation by the line spectrum of TV and broadcasing channels when changing over to the K-3600 transmission system.

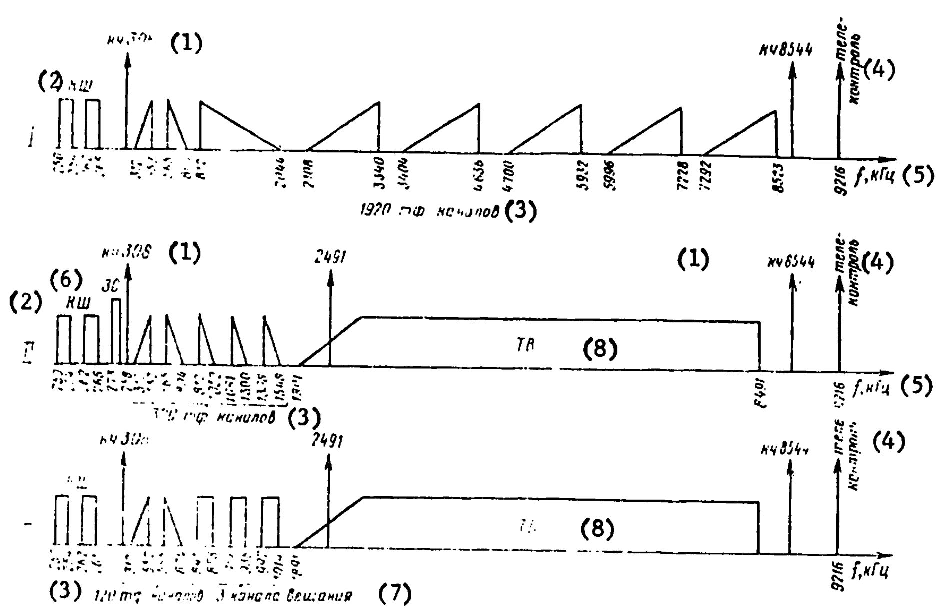

Figure 1

Key:
1. Pilot frequency
2. KSh [code bus]
3. Telephone channels
4. Telecontrol
5. kHz
6. ZS
7. Broadcasting channels
8. TV

In all variants of spectrum organization, its lower part is intended for operation of the equipment for noise power monitoring both in individual sections of OUP [attended repeater station]-OUP, and over the entire retransmission section (development of this equipment is not completed).

The K-1920P transmission system contains NUP [unattended repeater stations] of two types: basic and regulating. The basic NUP (their number on the main line constitutes approximately 75% of the total number of NUP) compensate the attenuation of the repeater section of the cable 6±0.3 km long at a soil temperature of +8 degrees C and do not contain regulating devices except those compensating the variations in the lengths of the repeater sections.

Regulating NUP are installed after each three basic NUP, preform their functions, as well as automatic gain control (ARU) depending on the changes in the attenuation of the cable at four repeater sections. ARU devices work when there are changes in the soil temperature and the level of the KCh [pilot frequency] of 8544 kHz. The regulation of gain by the soil temperature is ensured by preregulation at the output of the regulating NUP provided for in the transmission system.

The K-1920P transmission system uses OUP of the following types: without any additional functions (OUP); with TV channel branches (OUP-OT); with separation of groups of telephone channels (OUP-V); with separation and introduction of a TV channel (OUP-VT). The last type of OUP is used rarely and usually turns into a terminal point (OP).

ARU devices in OUP perform gain control only by the level of the KCh current. The devices of ARU by the basic KCh of 8544 kHz are supplemented by devices of ARU by an auxiliary frequency of 308 kHz. Moreover, it is possible to introduce a third KCh into the system, if it proves to be necessary from the results of tests and operation of the first main lines.

Remote monitoring of the condition of NUP amplifiers (their gain value) is performed from OUP through a special channel formed with the aid of filters included in each NUP between the routes of the opposite directions of transmissions. The filters have a passband of the order of 140 kHz and a medium frequency of 9216 kHz. Test signals, which are currents of 9216 kHz modulated by a quasi-random sequence of pulses, form in the transmitting part of the monitoring equipment. During the monitoring periods, they arrive from the OUP at the outgoing channel and return through the incoming channel. The time selection and analysis of the arriving response signals from all NUP of the maintenance section are performed in the receiving part of the monitoring equipment.

A block diagram of the main line with indications of maximum distances between individual points and the main composition of the equipment of stations of all types is shown in Figure 2, where SS, SLUK, SDP-4, STVT, STM, SKTT, SDKT are, respectively: coupling bay, line amplifier and corrector bay, remote power supply bay, television lead-in bay, telemechanics bay, TV channel correction bay, remote channel monitoring bay; TTs -- television center; KTPP -- direct communication channel set; KPVV -- tone frequency channel conversion, separation and lead-in set.

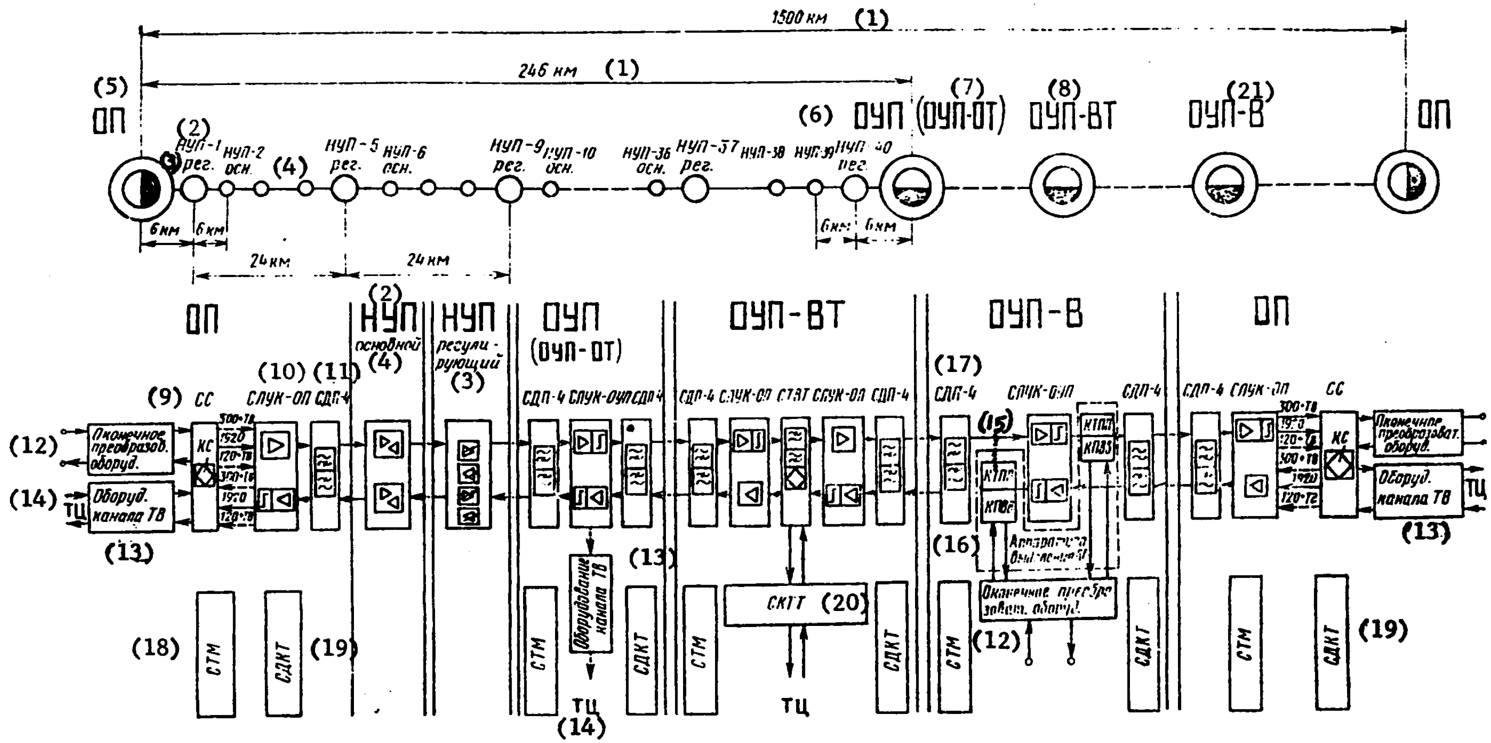

Figure 2

Key:
1. km
2. NUP
3. regulating
4. basic
5. OP
6. OUP
7. (OUP-OT)
8. OUP-VT
9. SS
10. SLUK-OP
11. SDP
12. Terminal conversion equipment
13. TV channel equipment
14. TTs
15. KTPP
16. Separation equipment
17. SDP
18. STM
19. SDKT
20. SKTT
21. OUP-V

The new K-1920P equipment complex is distinguished by a high degree of unification with equipment of the same type of the K-3600 transmission system [4]. The equipment of the distributive transmission system K-24R, remote power supply, service communication and telemechanics, device for cable entrance into NUP, and the majority of the devices of auxiliary equipment have been completely standardized. Containers of the high-frequency equipment of NUP and high-frequency equipment of OUP (OP) -- SLUK bays have been standardized structurally.

The equipment ensuring the organization of TV channels was developed with consideration of the experience in creating analogous devices of the K-3600 transmission system. The equipment for monitoring the operating conditions of NUP of K-1920P was developed on the same principles and structural basis as in K-3600, and differs only in the pilot frequencies, i.e., line frequency spectra.

Line Amplifiers. The equipment of the line circuit K-1920P for NUP uses two types of amplifiers: BUL (line amplifier unit) and BUR (regulating amplifier unit). The former is installed in the containers of the basic NUP, and the second in the containers of regulating NUP.

The line amplifier BUL has four stages and is fully transistorized: KT-335A -- in the first two stages, KT-610A -- in the third stage, and KT-904A -- in the fourth stage. The maximum undistorted power at the output of the amplifier is +16 dBn (300 mW).

The frequency characteristic of the amplifier is formed by line equalizer which is installed at the input of the amplifier and by the circuit connected in the feedback circuit. The amplitude-frequency characteristic (AChKh) of the amplifier corresponds to the attenuation of the coaxial cable with pairs of 2.6/9.4 mm 6 km long at t^o = +8 degrees C. The negative feedback circuit (OOS) of the amplifier has a manual gain control which makes it possible to change the gain depending on the length of the repeater section within the limits of 5.7-6.3 km in steps of 0.1 km. The input and the output of the amplifier has protective devices again the effects of lightning discharges. The power supply device provides for protection against the influence of LEP [electric power transmission lines].

The thermal noise level at the output of the amplifier adjusted to its input is 142 dBn on a frequency of 8.0 MHz, 137.5 dBn on a frequency of 4.0 MHz, and 126 dBn on a frequency of 0.5 MHz.

Nonlinearity attenuation at a fundamental frequency of 0.4 MHz and the output level on the second harmonic is not less than 88 dB, and on the third harmonic -- not less than 96 dB. Nonlinearity attenuation on the second harmonic at a fundamental frequency of 4.2 MHz is not less than 72 dB, and on the third harmonic at a fundamental frequency of 2.8 MHz -- not less than 91 dB. The attenuation of mismatching at the input and output of the amplifiers within the frequency range 2-8.6 MHz -- not worse than 25 dB, and within the range 0.3 -- 2.0 MHz -- not worse than 20 dB.

The BUR amplifier contains two amplifiers: linear and flat. The term "flat" is understood to be an amplifier with a frequency-independent gain characteristic. Moreover, BUR have: a receiver of the pilot channel of the fundamental KCh of 8544 kHz, a variable equalizer of ARU [automatic gain control] (VP ARU), and a device for gain control by the soil temperature (TRU).

In the experimental model of NUP, the variable equilizer of ARU is included between the linear and flat amplifiers. Gain adjustment depending on the length spread of adjoining repeater sections (RRU) is done in the OOS circuit of the linear amplifier. In the series-produced equipment, the VP ARU circuit is included in the OOS circuit of the linear amplifier, and the RRU circuit is connected at the input of the BUR unit.

The TRU circuit is connected to the OOS circuit of the flat amplifier; its characteristics are controlled by a temperature sensor buried in the ground at a distance of approximately 10 m from the NUP.

The limits of gain adjustment on a frequency of 8.6 MHz by KCh are ±3.5 dB; by the soil temperature -- ±2.1 dB. On the remaining frequencies of the range used, changes in the gain take place depending on $\sqrt{f}$.

Attenuation of nonlinearity of the BUR at the same output level as in the BUL, is normalized by 6 dB lower than in the BUL.

The OUP equipment has amplifiers of reception and flat amplifiers. With respect to its design and characteristics, the amplifier of reception is the same as the linear amplifier of BUR. The OOS circuit of flat amplifiers of OUP performs frequency-independent adjustment of the gain characteristic by ±1.0 dB. Structurally, these variants of amplifiers are designed in application to the structure of the OUP bay.

Service traffic is organized through symmetrical pairs with conductors 0.9 mm in diameter. The number of the available conductors makes it possible to organize two four-wire channels through the KM-4 cable for station service traffic (PSS-1 and PSS-2) and one two-wire channel for section service traffic (USS). When the KMB-8/6 cable is used, the number of PSS channels increases to three. These channels ensure the transmission of frequency spectra from 0.3 to 3.4 kHz, and through the USS channel -- from 0.3 to 2.6 kHz.

Stations service traffic is organized in the OP-OP section of up to 1500 km between the OP themselves and between the OP and OUP; section service traffic is organized between OUP and NUP situated in sections adjoining the OUP through a coil-loaded pair with terminal amplifiers without intermediate amplifiers.

When the PSS is organized, intermediate amplifiers are installed every 30 km, as well as terminal amplifiers in OP and OUP. Selective calls through PSS channels are made with the aid of a TV [voice-frequency ringing] oscillator on 23 fixed frequencies; simultaneous calls to all OUP -- by a conference call on a frequency of 2460 Hz; a call to OUP from NUP -- with the aid of telemechanics devices; a call to NUP from OUP -- by a phonic signal with a frequency of 1020 Hz.

The service traffic equipment in OP and OUP is arranged on the SS bay. USS and PSS-2 channels can be used for communicating with NUP. A portable speaking set (PPU) containing terminal amplifiers of tonal frequency with gain control is connected to the SS channels in NUP. It is possible to connect to the USS channel through a socket situated on the TM [telemechanics] container or through a socket on the ground part of the NUP, and to the PSS-2 channel -- only through the socket on the container.

Telemechanical Systems. The transmission systems K-3600 and K-1920P have two kinds of telemechanical systems: section telemechanical system (TMU) and main-line telemechanical system (TMM).

TMU systems are intended for receiving at the OUP (OP) announcement signals transmitted from NUP of adjoining service sections. These systems are used to transmit control commands to NUP in order to connect measuring oscillators (if this is required for monitoring the amplifiers of the NUP). The TMU equipment is located in telemechanics units (BTM) in NUP, and on separate telemechanics bays (STM) in OUP. The TMU operate through four signal conductors 0.9 mm in diameter.

OUP can receive eight announcement signals from each NUP, and NUP can receive six control commands from each OUP.

The TMU devices are using a time-cycle method of interrogating NUP in the service sections. For this purpose, the TMU equipment at OUP have an oscillator of timing pulses which are relayed to all BTM in NUP. OUP and NUP have signal distributors which operate synchronously and cophasally. Moreover, OUP have a distributor of NUP numbers. BTM in NUP have a remote supply system through phantom circuits organized through conductors set aside for the operation of TMU.

The main-line telemechanical devices TMM make it possible to monitor the condition of high-frequency channels on terminal or retransmission centers in all main line sections. Monitoring signals are formed in all OUP on the basis of signals arriving via the TMU system from NUP with addition of signals from local sensors.

The TMM system uses a reversible consecutive method of interrogating all OUP and OP of the main line, for which purpose there are regenerative repeaters of the amplitude and length of transmitted pulses every 18 km, at each third NUP.

As a result of the processing of all arriving signals, four announcement signals are transmitted to OP from each OUP; "normal", "warning", "damage", "emergency".

Two signal conductors 0.9 mm in diameter are set aside for the operation of the TMM system.

Electric power supply for the K-1920P equipment, including remote supply, is received from a direct-current source of 24 V ±10%. The positive pole is grounded. The equipment of each transmission system is fed independently, and NUP equipment has a remote power supply with stabilized direct current through internal conductors of coaxial pairs with series connection of loads in the DP [remote power supply] circuit. The current in the DP circuit is 340 mA; the voltage delivered to the internal conductors of two coaxial pairs from attended stations, depending on the number of NUP, is from 50 to 1500 V.

The DP equipment is arranged on the remote power supply bay SDP-4.

Unattended Repeater Stations. The degree of automation of main coaxial cable lines is determined by the number of repeater stations operating without attending personnel. NUP equipment is located in underground metal tanks. As a result of this, insignificant fluctuations of the soil temperature at the depth of the location of the tank, in comparison with the fluctuations of the air temperature on the surface of the ground, do not affect the stability of the operation of the repeater equipment. This makes it possible to minimize the inspection of NUP by the operating personnel.

The fourth page of the magazine cover shows a NUP container K-1920P containing two units with line amplifiers for the basic NUP. Containers with NUP equipment are installed in tanks on special frames.

Small dimensions of transistorized equipment and smaller amounts of liberated heat than that of tube equipment made it possible to reduce the overall dimensions of the tank. The tanks developed by TsNIIS [Central Scientific Research Institute of Communications] have a diameter of 2.6 m and length of 2.4 m, and are intended for installation of containers of NUP of all types of the transmission systems K-3600 and K-1920P with the use of the cable KMB-4 or KMB-8/6, as well as the system VLT-1920.

Figure 3 shows the general appearance of a NUP installed in the ground. The NUP has five cable lead-in holes: two holes 60 mm in diameter for the main-line cable of both directions and three holes 20 mm in diameter for cables from ARU temperature sensors and a branch cable. Technicians enter the NUP through a manhole located in the upper part of the tank. Containers are fastened with bolts to special removable frames of the tank.

Two types of tanks are produced: with frames for fastening the equipment of K-3600 or K-1920P and with frames for fastening the equipment of VLT-1920. The tanks are covered on the outside with a special anticorrosive layer of bitumen with a fiber glass fabric. Moreover, in order to protect it against corrosion, negative potential is delivered on the body of the tank with the aid of four magnesium electrodes buried near the NUP.

The sensors located in the NUP transmit to the OUP with the aid of telemechanical devices signals about the opening of the manhole, about the appearance of water in the NUP, and about the dropping of air pressure in the cable, and from the points with ARU -- signals about the lowering of the KCh level, etc.

Main cables entering the tank terminate in terminal cable devices (UOK) to which containers are connected with the aid of flexible station cables.

Arrangement of Equipment. The equipment of OP and OUP is arranged in bays of a functional unit design of 2600 X 680 X 225 mm. The external appearance of the bay of line repeaters and correctors of terminal points (SLUK-OP) is shown on the fourth page of the magazine cover.

Results of Line Tests. The state tests of the specimens of the line equipment complex of K-1920P conducted in an experimental section of the main line of 115.7 km containing the equipment of 14 basic and 5 regulating NUP, as well as the equipment of OP and OUP showed the following.

The divergence between the AChKh of the gain of line repeaters and the attenuation of the cable sections is not over 0.1 dB, the power of total interference of the line circuit in the band of the TCh channel at the loading of the channels by white noise signals of 50 microvolts at the point of the relative zero level is not more than 1 pkW·psoph/km.

The equipment ensures high stability of the overall loss of the line circuit. The dynamic characteristics of the line circuit correspond to the MKKTT [International Telegraph and Telephone Consultative Committee] standards. Protective devices ensure normal operation of the line with all types of regulated external influences.

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PUBLICATIONS, INCLUDING
COLLECTIONS OF ABSTRACTS

ABSTRACTS FROM THE COLLECTION 'MODERN METHODS OF SIGNAL PROCESSING'

Moscow TRUDY MOSKOVSKOGO ORDENA LENINA ENERGETICHESKOGO INSTITUTA: TEMATICHESKIY SBORNIK: SOVREMENNYYE METODY OBRABOTKI SIGNALOV in Russian No 455, 1980 (signed to press 26 May 80) pp 2, 147-154

[Annotation and abstracts of articles from the collection "Transactions of the Moscow Order of Lenin Power Engineering Institute: Topical Collection: Modern Methods of Signal Processing", edited by Professor G. D. Lobov, 300 copies, 154 pages]

[Text] The material of this collection treats urgent problems of modern science and technology. Investigation of new principles of signal processing and their practical application are developing widely. This is connected with the development of new functional assemblies for radio electronics. This collection presents the results of studies of some general principles of signal processing, functional processing devices with the use of new physical principles and the results of work on the synthesis of new materials for such devices. In accordance with these directions of studies, the material of the collection is divided into three topical sections.

The articles in this collection are the results of original studies by the authors on the above-mentioned problems. On the whole, the collection will be useful for a broad section of scientists and engineers working in the area of radio electronics and related areas of science and technology.

UDC 621.371

ON THE INFLUENCE OF A DISPERSIVE MEDIUM IN A RADIO COMMUNICATION CHANNEL ON MATCHED RECEPTION OF PHASE-MANIPULATED SIGNALS

[Abstract of article by Kramm, M. N.]

[Text] The author examines the passage of radio signals through a section of a radio communication channel which includes a dispersive medium and an optical processing device -- matched filter. The results of calculations are given for signals with phase manipulation by the Barker code. The shape of the signal envelope at the output of the matched filter is analyzed for various combinations of the parameters of the signal and the medium.

UDC 621.391.81

APPROXIMATION OF THE SHAPE OF ANOMALOUS OVERSHOOTS OF THE PHASE, FREQUENCY, AND THE ENVELOPE OF THE SUM OF THE SIGNAL AND NOISE BY THE MOST PROBABLE TRAJECTORIES

[Abstract of article by Zhukov, V. P., Ivanova, N. N., and Razumov, L. A.]

[Text] The authors found relations describing changes in the phase, frequency, and the envelope of the sum of the signal and narrow-band Gaussian noise at phase jumps by $\pm 2\pi$. The solution is done by the method of the most probable trajectories. Distribution functions of random parameters determining the shapes of such trajectories are given.

UDC 621.391

ACCURACY OF THE IDENTIFICATION OF THE PARAMETERS OF A MULTIBEAM COMMUNICATION CHANNEL AGAINST THE BACKGROUND OF QUASI-STATIONARY GAUSSIAN INTERFERENCE

[Abstract of article by Arapov, S. M.]

[Text] The author examines the block diagram of subsystems of the identification of the parameters of a multibeam receiver. Basic relations describing the operation principle are obtained. Conditions are found in which the accuracy of identification increases. The dependence of the accuracy of identification on the signal phase is found.

UDC 621.398.1

INVESTIGATION OF SIGNAL PROCESSING ERRORS IN MEASURING SHORT DISTANCES WITH THE AID OF ULTRASOUND

[Abstract of article by Ragozin, Yu. D., Volosskiy, V. P., and Pakhomov, V. P.]

[Text] The authors examine basic sources of errors occurring in measuring short distances with the aid of ultrasound. They show that measurement errors under certain conditions can be reduced to decimal fractions of a millimeter.

UDC 621.391.272:539.143

METHOD ERRORS IN PROCESSING SIGNALS WITH THE AID OF SPIN ECHO

[Abstract of article by Kalinin, V. A.]

[Text] The author examines errors in the realization of the signal correlation and delay functions connected with the properties of pulses of primary and stimulated echo. Errors are found in solving Bloch equations by the method of successive approximations. The author determined the errors connected with an insufficient amplitude of the reading pulse and excessively great intensity of the input signals. Requirements for the parameters of signals and the reading pulse are formulated.

UDC 620.179.162

ANALYSIS OF THE SPECTRUM OF PULSED SIGNALS DURING ULTRASONIC CHECKING OF MULTILAYER MEDIA

[Abstract of article by Skogorev, M. Ye.]

[Text] The author examines the spectrum of a signal occurring during ultrasonic checking of layered media. It is shown that the spectrum can be used for obtaining information about the gluing layer. The bifurcation of the resonance peaks of the spectrum revealed in the experiment is connected with the resonances within the layered material itself.

UDC 621.38

THERMAL STABILITY OF MEMORY DEVICES USING CHALCOGENIC GLASS-LIKE SEMICONDUCTORS

[Abstract of article by Borovov, G. I. and Voronkov, E. N.]

[Text] The authors give the results of experimental studies of a memory matrix K524RPI. It is shown that thermal properties of an instrument are determined chiefly by the properties of the glass. They obtained the parameters of a kinetic equation of crystallization which make it possible to evaluate the service life of an instrument at higher temperatures. The results indicate the necessity of using glass with high values of activation energy.

UDC 621.379.54

COMPUTATION OF FILTERS ON ACOUSTIC SURFACE WAVES WITH NONEQUIDISTANT COUNTER-PIN CONVERTERS

[Abstract of article by Kartashev, V. G.]

[Text] The author examines the synthesis method of band filters on acoustic surface waves with two identical nonequidistant counter-pin converters. He concludes that, in order to obtain a prescribed frequency characteristic close to rectangular, it is necessary to achieve the amplitude apodization of at least one converter. The characteristics of filters synthesized by this method are given.

UDC 621.37:534

TEMPERATURE DEPENDENCE OF THE PHASE AND AMPLITUDE OF THE OUTPUT SIGNAL IN AN AMPLIFIER OF ACOUSTIC SURFACE WAVES

[Abstract of article by Gavrilin, V. I., Gulyaev, A. M., Karpeyev, D. V., and Bashkirov, A. M.]

[Text] The authors give the results of their experimental studies on the characteristics of an amplifier of acoustic surface waves in a range from 100 to 400 K. It is shown that, when the temperature decreases, the losses increase and there are changes in the phase of the signal at the output of the amplifier. It is concluded that the increase of losses is connected with the increase of acoustoelectronic interaction.

UDC 620.179.1

PROBLEMS OF PROCESSING ROENTGEN-TELEVISION SIGNALS

[Abstract of article by Volkov, A. V., and Zorin, A. Yu.]

[Text] This article gives the results of studies on the use of series-produced ultrasonic delay lines in television roentgen defectoscopy of reinforced objects. Circuit diagrams of matching and use in the radio-pulse and video-pulse modes are given. Requirements for the delay lines for the above method of defectoscopy are formulated. It is indicated that it is necessary to develop delay lines for a carrier frequency of about 30 MHz.

UDC 621.391.272:539.143

EFFECTS OF THE SHAPE OF THE WORKING BODY ON THE TRANSMISSION COEFFICIENT OF A SPIN FUNCTIONAL ASSEMBLY

[Abstract of article by Ivanov, Yu. V., Lobov, G. D., and Shtykov, V. V.]

[Text] On the basis of the known solution of the Bloch equation, the echo signal voltage was found at the output of a spin functional assembly with consideration for the configuration of the working body and the registering coil. Results of computer computations for a toroidal core are given. It is shown that cores with a minimum radius-thickness ratio should be used in order to increase the transmission coefficient.

UDC 621.179.1

ELECTROACOUSTIC CONVERTERS OF SYSTEMS FOR OPTIMAL PROCESSING OF ULTRASONIC SIGNALS

[Abstract of article by Aksenov, V. P., and Popko, V. P.]

[Text] On the basis of the analysis of methods of optimal processing of signals, the authors determined the requirements for the parameters of electroacoustic converters for instruments of ultrasonic nondestructive inspection. Designs of proposed modifications of wide-band electroacoustic converters are described and experimental data confirming the correctness of the initial theoretical premises are given.

UDC 621.37:534

ON THE POSSIBILITY OF USING THE ACOUSTOMAGNETOELECTRIC EFFECT FOR STUDYING THE PROPERTIES OF AMPLIFIERS OF ACOUSTIC SURFACE WAVES

[Abstract of article by Gavrilin, V. I., Gulyayev, A. M., Karpeyev, D. V., and Praporshchikov, V. V.]

[Text] The authors propose a new method for studying the characteristics of amplifiers of acoustic surface waves. Results of their studies are given. It is shown that this method will be useful for studying the parameters of carriers in the area of acoustoelectronic interaction not only of amplifiers, but also of other instruments with a layered piezoelectric-semiconductor structure.

UDC 621.373.12

SELF-OSCILLATOR ON THE DELAY LINE OF ACOUSTIC SURFACE WAVES WITH EXTERNAL SYNCHRONIZATION

[Abstract of article by Dvornikov, A. A., Ogurtsov, V. I., and Utkin, G. M.]

[Text] The authors examine a self-oscillator on a delay line of acoustic surface waves with external synchronization. They analyze shortened equations of such an oscillator. For the cubic approximation of the dependence of the output current of the active element, characteristics of a synchronized oscillator of this type are given. Qualitative experimental confirmation of the theoretical results is obtained.

UDC 621.372.8

FILTRATION OF PARASITIC WAVES IN MEANDER-TYPE STAGGERED PRINTED DELAYING SYSTEMS

[Abstract of article by Berezin, V. M., Guttsayt, E. M., Mal'tov, V. N., and Skripov, A. A.]

[Text] The authors investigated the possibility of effective suppression of parasitic waves of antiphase oscillations in a two-storeyed meander by means of filters on the basis of subsidiary delaying systems of printed ring vibrators which in combination with a clamp-type systems make it possible to obtain losses of 1.3-1.5 dB per cell, while the losses at the working type of oscillations are not over 0.05 dB per cell.

UDC 621.38

DEVICE FOR AUTOMATIC REGISTRATION OF THE DRIFT OF VOLT-FARAD CHARACTERISTICS IN THE PROCESS OF TEMPERATURE AND FIELD TESTS

[Abstract of article by Sobolev, M. V., Korchagin, S. N., Kolomeychuk, A. S., Varlashov, I. B., and Soldatov, V. S.]

[Text] The authors give a block diagram of a device for registering volt-farad characteristics in the process of temperature and field tests. They describe the method of measurements. The developed device makes it possible to register a shift in the volt-farad characteristics of 0.05 V at a time constant of not less than 0.1 sec. Comparison with the standard method indicated the correctness of results obtained by this method.

UDC 621.373.826

OPERATIONAL CHARACTERISTICS OF A PYROMAGNETIC RECEIVER OF INFRARED RADIATION

[Abstract of article by Lobov, G. D., Shtykov, V. V., and Drugov, L. V.]

[Text] Results of experimental studies of a pyromagnetic detector are given. The functional scheme of the experiment is described. Experimental relations are compared with theoretical relations obtained for the simplest model of this phenomenon. Recommendations are given for improving the characteristics of the receiver.

UDC 534.422.8.063

PROBLEMS OF THE METHODS OF ROENTGENOSPECTRAL MICROANALYSIS OF MULTICOMPONENT GARNET SYSTEMS

[Abstract of article by Tsvetkova, A. A., Yegorov, S. K., and Kon'kova, M. M.]

[Text] The authors examine the peculiarities of conducting quantitative analysis in the system $Gd_{3-x}Ca_xGa_{3-y}Zr_yO_{12}$. Single crystals and polycrystals were used as samples. Problems of the methods of preparing samples and standards are discussed. Stoichiometric peculiarities of this system are examined.

UDC 535.212.

DETERMINATION OF THE SPEED OF THE MOTION OF TRANSLATION OF CYLINDRICAL MAGNETIC DOMAINS BY THE PHOTOELECTRIC METHOD

[Abstract of article by Nikolayev, L. V.]

[Text] The author proposes a method making it possible to determine the speed of motion of cylindrical magnetic domains in a Bi-containing film of ferrite garnets without possible errors connected with the inertia effect during the motion of translation of the domain (ballistic effect). A scheme for the realization of the proposed method is given.

UDC 621.365.6

EFFECTS OF TECHNOLOGICAL CONDITIONS ON THE CONFIGURATION OF THE THERMAL FIELD IN MELTS DURING CZOCHRALSKI CRYSTAL GROWTH FROM A COLD CRUCIBLE

[Abstract of article by Balbashov, A. M., and Zavartsev, Yu. D.]

[Text] Negative results during the growing of crystals from a cold crucible are caused by unfavorable distribution of temperature in the melt which is characterized by the overheating of the central areas. The authors show that it is possible to obtain a favorable configuration of the thermal field in the melt by controlling the size and direction of the convection flow.

UDC 621.317

STATIC MAGNETIC CHARACTERISTICS OF Bi-CONTAINING GARNET FILMS

[Abstract of article by Pavlova, S. G., and Cherkasov, A. P.]

[Text] The authors give the results of their experiments in the investigation of static magnetic properties of garnet films of the systems $(Yb\ Gd\ Bi)_3\ (Fe\ Al)_5\ O_{12}$; $(YBi)_3\ (Fe\ Ga)_5\ O_{12}$. They studied the behavior of a domain structure in the temperature interval from -100 degrees C to the Curie point. Conclusions are made on the optimization of the compounds in the studied systems in order to increase the thermal stability of magnetic characteristics.

UDC 621.317:535.212

SYNTHESIS OF MULTILAYER FILMS IN THE SYSTEM $(YBi)_3$ $(FeCa)_5$ O_{12} AND INVESTIGATION OF THE BLIND DOMAIN STRUCTURE IN THEM

[Abstract of article by Cherkasov, A. P., Chervonenkis, A. Ya., Cheparin, V. P., and Shupegin, M. L.]

[Text] The authors describe methods of synthesizing multilayer Bi-containing garnet films possessing a prescribed profile of magnetic constants over their thickness. They give results of their studies on variants of blind domain structures in such films. They suggest the uses of blind domains in the information and measuring techniques.

UDC 621.317:535.212

OPTICAL ABSORPTION SPECTRA OF EPITAXIAL FILMS OF Bi-CONTAINING GARNETS

[Abstract of article by Balbashov, A. M., Bakhteuzov, V. Ye., Tsvetkova, A. A., and Chervonenkis, A. Ya.]

[Text] The authors analyzed absorption spectra of epitaxial films of Bi-containing garnets in the 0.4-2.5 micron range. They revealed individual contributions into the absorption of ions Bi, Pb^{2+}, Pb^{4+}, Fe^{2+}, Fe^{4+}, Co^{2+}. Corresponding curves of additional absorption make it possible to evaluate the concentration of the above ions and optimize the conditions of synthesis.

UDC 621.317:533.9.74

SELECTION OF THE PARAMETERS OF A SIMICONDUCTOR FOR OBTAINING THE MAXIMUM MAGNETIC MOMENT OF THE ELECTRONS AT A ZERO MAGNETIC FIELD

[Abstract of article by Gratsianskaya, Ye. I.]

[Text] The author calculated the magnetic moment of electrons of the conductivity zone of a semiconductor in the absence of a constant magnetic field when an electromagnetic wave with circular polarization falls on the specimen.

10,233
CSO: 1860/211

ELECTRICAL ENGINEERING HANDBOOK (IN THREE VOLUMES): VOLUME 1; GENERAL ASPECTS. ELECTRICAL ENGINEERING DATA

Moscow ELEKTROTECKHNICHESKIY SPRAVOCHNIK (V TREKH TOMAKH): TOM 1; OBSHCHIYE VOPROSY. ELEKTROTEKHNICHESKIYE MATERIALY in Russian 1980 (signed to press 5 Jun 80) pp 2, 5-7, 23-24, 69, 106-7, 175, 222, 248-9, 263, 287, 316, 325, 351, 397, 422, 481

[Annotation and section tables of contents from book "Electrical Engineering Handbook (in Three Volumes): Volume 1; General Aspects. Electrical Engineering Data", edited by I. V. Antik, Izdatel'stvo "Energiya", 80,000 copies, 520 pages]

[Text] This volume contains information on the theoretical bases of electrical engineering, on the electrophysical properties of conductors, semiconductors and insulators, on the general aspects of electrical equipment and safety engineering, on relevant papers on electrical engineering, on the measurement of electrical and magnetic quantities and on cable equipment. Instructions are given regarding the execution of drawings and circuit designs. The preceding fifth edition of this handbook was published in 1974.

It is intended for a broad circle of electrical engineers.

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Volume One Contents

9512
CSO: 1860/243

ELECTRIC POWER-SUPPLY SOURCES WITH SPECIAL CHARACTERISTICS

Kiev ISTOCHNIKI ELEKTROPITANIYA SO SPETSIAL'NYMI KHARAKTERISTIKAMI in Russian 1979 (signed to press 6 Feb 79) pp 2, 162-3, 165-71

[Annotation, table of contents and list of abstracts from book "Electric Power-Supply Sources With Special Characteristics", edited by N. I. Sukhomlinskaya, Izdatel'stvo "Naukova dumka", 1,500 copies, 172 pages]

[Text] This collection includes papers devoted to the development and investigation of electromagnetic and semiconductor devices for the regulation and stabilization of current, voltage, power and other parameters influencing the working capacity and efficiency of electrical and electronic equipment. This collection covers questions of the theory and practical application of regulators of electrical quantities as applied to loads having variable parameters.

This collection is intended for scientific and engineering workers specializing in the fields of transformer engineering and automation equipment.

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UDC 621.372.061

INDUCTIVE-CAPACITIVE CONVERTERS WITH REGULATED AMPLITUDE AND CONSTANT PHASE FOR THE OUTPUT CURRENT

[Abstract of article by Volkov, I. V., Gubarevich, V. N., Isakov, V. N., and Kaban, V. P.]

[Text] This article presents circuits of three-phase inductive-capacitive converters whose regulating element is a choke with a rotating magnetic field. It is shown that the circuits described make it possible to employ a smooth contactless method of regulating the level of stabilized current in a load while keeping its phase unchanged. Areas for the practical application of the circuits studied are determined. 6 illustrations, 6 titles in bibliography.

UDC 621.372.061

THE APPLICATION OF WAVE MATRICES IN THE STUDY OF INDUCTIVE-CAPACITIVE CONVERTERS

[Abstract of article by Volkov, I. V., and Smolyanskiy, I. I.]

[Text] The article examines questions of the application of wave-matrix apparatus in the study of multiphase inductive-capacitive converters. It assesses the capabilities of inductive-capacitive converters in connection with their power characteristics and the application of the given apparatus. It also cites conditions under which these characteristics are optimal.

Further approaches are outlined for the effective utilization of wave matrices in the study of inductive-capacitive converters. 1 illustration, 8 titles in bibliography.

UDC 621.372.061

TWO-ELEMENT CIRCUITS FOR INDUCTIVE-CAPACITIVE CONVERTERS

[Abstract of article by Gubarevich, V. N., Isakov, V. N., and Kaban, V. P.]

[Text] The article provides a comparative analysis of two-element circuits for inductive-capacitive converters. General mathematical relationships are obtained for converters of L-type structure which make it possible to carry out the best possible selection of this or that circuit when designing specific equipment with given specificiations. 3 illustrations, 4 tables, 1 title in bibliography.

UDC 621.372.061

П-TYPE CIRCUITS FOR THREE-PHASE INDUCTIVE-CAPACITIVE CONVERTERS

[Abstract of article by Gubarevich, V. N., Isakov, V. N., and Kaban, V. P.]

[Text] The article analyzes various methods of connecting the phase e.m.f. of a three-phase power supply network to inductive-capacitive converters of П-type structure. Formulas are obtained for calculating the parameters of the current source. Recommendations are given regarding the selection of the most efficient circuits. 5 illustrations, 3 tables, 3 titles in bibliography.

UDC 621.372.061

CALCULATION OF THE SPECTRAL COMPOSITION OF NONSINUSOIDAL CURRENTS IN AN INDUCTIVE-CAPACITIVE CONVERTER USING A DIGITAL COMPUTER

[Abstract of article by Kalinin, V. N., and Kusnetzov, O. G.]

[Text] This article examines the use of a digital computer to calculate the amplitude, frequency and phases of the harmonic components of a nonsinusoidal function with regard to its discrete spectrum over a finite interval of time. An algorithm is suggested and its flow-chart is presented. Results obtained are illustrated by examples of calculation. 2 illustrations, 2 titles in bibliography.

UDC 621.372.061

POWER RELATIONS AMONG COMPONENTS OF POLYHARMONIC OSCILLATIONS ARISING IN A SINGLE-PHASE INDUCTIVE-CAPACITIVE CONVERTER

[Abstract of article by Kusnetzov, O. G., and Kalinin, V. N.]

[Text] Based on power relationships, this article proves the existence of steady-state nonsinusoidal oscillations in whose spectrum at amplitude predominate the harmonics of frequencies ω and $\omega + \Delta\omega$, where ω is the frequency of the converter's sources of e.m.f. 1 illustration, 2 titles in bibliography.

UDC 621.314.572

STRUCTURES OF COMPOSITE POWER-SUPPLY SYSTEMS

[Abstract of article by Lipkovskiy, K. A., and Aleksandrov, M. M.]

[Text] The article examines the construction of power-supply systems which are various combinations of voltage and current sources. Structures are analyzed for composite power-supply systems and conditions are ascertained in each of the combinations which make it possible to stabilize the load current. 2 illustrations, 1 table, 4 titles in bibliography.

UDC 621.372.061

EFFECT OF PARAMETER VARIATIONS ON THE OPERATION OF AN INDUCTIVE-CAPACITIVE CONVERTER IN THE CONSTANT CURRENT-CONSUMPTION MODE

[Abstract of article by Zakrevskiy, S. I., and Basan'ko, Yu. V.]

[Text] This article analyzes the operation of a three-phase bridge-type circuit for an inductive-capacitive converter in the constant consumption-current mode with variation in the circuit element parameters and the supply-voltage frequency. 4 illustrations, 4 titles in bibliography.

UDC 62.83.001.5

CONTROLLED-VELOCITY DIRECT-CURRENT ELECTRIC DRIVE SUPPLIED FROM A PARAMETRIC POWER SOURCE

[Abstract of article by Samcheleyev, Yu. P., Obukhov, S. G., Kalyuzhnyy, V. V., and Komarskiy, V. V.]

[Text] Principles are examined for the construction of reversible and nonreversible electric drives when the DC motor's armature is supplied from a parametric current source.

The suggested drive systems possess high dynamic and static indicators, simplicity of circuit design and reliability. Control is accomplished at the motor's armature circuit. 2 illustrations, 4 titles in bibliography.

UDC 62.83.001.5

SYNTHESIS OF AUTOMATIC VELOCITY-CONTROL SYSTEMS WHEN A DIRECT CURRENT MOTOR IS SUPPLIED FROM A POWER SOURCE

[Abstract of article by Samcheleyev, Yu. P., Zhilyakov, V. I., Kalyuzhnyy, V. V., and Chernoivan, V. P.]

[Text] This article synthesizes the structure of a DC electric drive when the current is provided by a parametric current source. Results are presented for a study of a drive based on a mathematical model and an actual unit. The electric drive possesses high response speed and simplicity of circuit design. 5 illustrations, 5 titles in bibliography.

UDC 621.314.722

ANALYSIS OF THE ELECTROMAGNETIC PROCESSES IN A THREE-PHASE SERIES-TYPE REGULATOR

[Abstract of article by Zozulev, V. I., Gorbachev, M. N., Zakrevskiy, S. N., and Inyakin, I. A.]

[Text] An analysis is given of the electromagnetic processes for periodic operation of a three-phase preresonant series-type voltage (current) regulator. Expressions are derived for the instantaneous values and the voltage and current waveforms at the regulator output are ascertained. 5 illustrations, 4 titles in bibliography.

UDC 621.316.721.1:621.382

TWO-TERMINAL CURRENT REGULATORS IN CIRCUITS WITH HIGH-VOLTAGE POWER LEADS

[Abstract of article by Dovgalevskiy, A. Yu., Starodumov, Yu. I., and Tsymbal, K. K.]

[Text] This article examines circuit designs for two-terminal current stabilizers possessing high values for the output resistance. Mathematical expressions are found and the characteristics of the stabilizers are analyzed. Experimental data are cited. 6 illustrations, 4 titles in bibliography.

UDC 621.314.26

CONTROL OF A THREE-PHASE ASYNCHRONOUS MOTOR BASED ON IMPULSE DURATION MODULATION OF ALTERNATING VOLTAGE CURVES

[Abstract of article by Grechko, E. N., Adamshin, M. M., Boyko, A. P., and Kutovoy, V. I.]

[Text] This article conducts a harmonic analysis of the alternating voltage curves processed through impulse duration modulation. The basic mathematical relations are derived. A thyristor device is described which controls an asynchronous electric drive and which realizes the given form of impulse duration modulation in the starting and stopping modes of operation. 2 illustrations, 3 tables, 3 titles in bibliography.

UDC 621.3:621.791.75

COMPARISON OF THE TECHNICAL-ECONOMIC CHARACTERISTICS OF AND LIMITATIONS ON THE APPLICATION OF RESERVOIR REACTORS WITH AND WITHOUT STEEL

[Abstract of article by Pentegov, I. V., and Legostayev, V. A.]

[Text] Questions are examined regarding the optimal geometry for reactors. Formulas are developed for determining their optimal geometric parameters. The article compares reactors with and without steel on the basis of weight and the cost of the core materials. Power engineering areas for the most profitable application of these types of reactors are indicated. 4 illustrations, 9 titles in bibliography.

UDC 621.314.061

IMPROVING THE QUALITY OF THE OUTPUT CURRENT FROM GATE-TYPE CONVERTERS THROUGH THE USE OF A REGULATED INDUCTIVE POWER-STORAGE CIRCUIT

[Abstract of article by Sarv, V. V.]

[Text] It is shown that the operating efficiency of an inductive power-storage circuit can be increased substantially and the spectral composition of the input and output currents of gate-type converter circuits can be improved while rhythmically varying the inductance of the storage circuit. This article examines the suitability of the proposed method in an alternating voltage regulator, in a rectifier and in a current inverter. 5 illustrations, 10 titles in bibliography.

UDC 621.318.434.1

SIMPLIFIED EQUATION FOR DESIGNING REACTORS WITH A LINEAR VOLTAGE-AMPERAGE CHARACTERISTIC

[Abstract of article by Spirin, V. M.]

[Text] A method is described for deriving a simplified equation for designing reactors with a linear voltage-amperage characteristic. The method is based upon the realization of the full factorial experiment 2^3 with the conversion of independent variables. An example is provided for deriving a simplified equation for the design of reactors for a specific case.

UDC 621.372.061

POWER CHARACTERISTICS OF REACTIVE TWO-TERMINAL NETWORKS

[Abstract of article by Tonkal', V. Ye., Bezgachin, N. I., and Nikitin, V. B.]

[Text] Questions are examined regarding the application of characteristic impedence and characteristic admittance functions for the analysis and synthesis of alternating current power circuits containing reactive elements. Four classes of two-terminal networks are analyzed with respect to the total output of the reactive elements. Features relating to the application of reactive and characteristic impedence and admittance are examined when calculations are performed on a digital computer. 3 illustrations, 1 table, 4 titles in bibliography.

UDC 621.317.619

INDUCTIVE-CAPACITIVE CIRCUIT FOR ZERO-SEQUENCE CURRENT COMPENSATION WITH NONSYMMETRY IN THE POWER-SUPPLY VOLTAGE

[Abstract of article by Kusnetzov, V. G., and Ugrimov, S. F.]

[Text] An analysis is made of the influence of voltage nonsymmetry and unbalance as well as of the variation in the element parameters in the zero-sequence inductive-capacitive current-compensation circuit due to calculated values. Formulas are presented which make it possible to assess the influence of these factors upon the current in positive and negative sequences during total and partial compensation of the zero-sequence current. 3 illustrations, 4 titles in bibliography.

UDC 621.326

COMPENSATION OF A THREE-PHASE SYSTEM WITH A NONSYMMETRICAL POWER SOURCE

[Abstract of article by Mostovyak, I. V.]

[Text] This article establishes conditions for balancing a three-phase system with a nonsymmetrical load. The nature of the balancing is determined. 2 titles in bibliography.

UDC 621.377.534.032.43

PRINCIPLES FOR CONSTRUCTING DEVICES FOR IGNITING GAS DISCHARGES

[Abstract of article by Starodumov, Yu. I.]

[Text] This article axamines various devices for igniting a gas discharge. The advantages and disadvantages of each are analyzed. Their areas of application are determined. Ignition systems are classified. 1 illustration, 9 titles in bibliography.

UDC 621.311.6:621.317.44

PULSE MAGNETIZING DEVICE WITH STABILIZATION OF THE DISCHARGE CURRENT AMPLITUDE AND THE TIME FOR CHARGING THE CAPACITOR BANK

[Abstract of article by Andriyevskiy, Ye. A., and Sheverdin, G. P.]

[Text] This article describes a pulse magnetizing device with stepped variable voltage supply to the capacitor bank and stabilization of the discharge current amplitude with variation in the parameters of the charging and discharging circuits and in the charge time of the pulse capacitor bank.

Mathematical expressions are presented which make it possible to select parameters for the circuit elements which will insure the stability of the discharge current and the charge time of the capacitor bank. 1 illustration, 4 titles in bibliography.

UDC 621.373.072.6

EFFECT OF POWER-SUPPLY VOLTAGE FLUCTUATIONS ON THE PULSE RECURRENCE RATE OF PULSE-CURRENT GENERATORS

[Abstract of article by Spirin, V. M., Krynko, N. V., and Kurach, A. M.]

[Text] This article provides an analysis of the influence of voltage oscillations in the power supply upon the pulse recurrence rate in pulse current generators of electrohydraulic installations. For pulse current generator circuit designs with inductive reactance in the primary alternating current circuit and with inductive-capacitive conversation of the voltage source to a current source, variation in the pulse recurrence rate is specified when there are fluctuations in the supply network voltage. 3 illustrations, 7 titles in bibliography.

UDC 621.382.2.014.2

STUDY OF THYRISTOR CONVERTERS WITH PARALLEL CAPACITIVE SWITCHING

[Abstract of article by Pavlov, V. B., Kravchenko, Yu. I., and Yakimov, O. S.]

[Text] Variants of circuit designs for thyristor direct-current interrupters. Their operational characteristics at low input voltage are shown. The circuit designs presented are calculated on a computer and the results of the machine computation are compared with the experimental results. A deduction is made regarding the unsuitability of shunting a power thyristor with a circuit of inductance and a diode when supplying the interrupter with parallel capacitive switching from a low-voltage source. 2 illustrations, 1 table, 3 titles in bibliography.

9512
CSO: 1860/223

UDC 621.371

EXPERIMENTAL STUDIES ON RADIO WAVE PROPAGATION

Moscow EKSPERIMENTAL'NOYE ISSLEDOVANIYE RASPROSTRANENIYA RADIOVOLN in Russian 1980 pp 2, 150-151

[Annotation and table of contents from book "Experimental Studies on Radio Wave Propagation", by V. Ye. Kashprovskiy, Institute of Terrestrial Magnetism, the Ionosphere and Radio Wave Propagation of the USSR Academy of Sciences, Izdatel'stvo'Nauka"]

[Text] On the basis of the analysis of propagation processes and properties of receiving antennas, the author studies the effects of their characteristics on the registered values of field intensity and the degree of their applicability in experiments. Modern methods of measuring low voltages are examined, fundamentals of the computation of dummy antennas are given, modern field recording instruments are described, and ways of increasing the accuracy of measurement are mapped out.

It is shown that multibeam propagation mechanisms impair the quality of radio channels and limit the volumes of information about propagation processes. The book gives an idea of the methods of oblique sounding and organization of measurements of the intensity of individual beams, their number, and angles of arrival at the reception point. Methods for measuring three components of the wave field are outlined. Methods for determining parameters of soils information on which is necessary for calculating antenna characteristics are presented. Recommendations are given for the planning of systems of oblique sounding of the ionosphere and systematic observations of propagation processes.

This monograph is intended for scientists and engineers, and for graduate and undergraduate students of vuzes engaged in studying propagation processes of radio waves controlling the work of real radio channels, as well as for designers of such instruments.

Figures -- 89, tables -- 2, bibliography -- 91 items.

Contents

10,233
CSO: 1860/221

UDC 620.17

FUNDAMENTALS OF THE ELECTROMAGNETIC METHOD OF STRESS ANALYSIS IN ANISOTROPIC MEDIA

Kiev OSNOVY ELEKTROMAGNITNOGO METODA ISSLEDOVANIYA NAPRYAZHENIY V ANIZOTROPNYKH SREDAKH in Russian 1980 (signed to press 3 Oct 79) pp 2-4

[Annotation and table of contents from the book "Fundamentals of the Electromagnetic Method of Stress Analysis in Anisotropic Media", by Ivan Petrovich Vasil'chenko and Bogdan Lyubomirovich Pelekh, Izdatel'stvo "Naukova dumka", 1150 copies, 116 pages]

[Text] This monograph presents a method for determining stress-strain conditions in anisotropic media through the use of the non-visible region of the electromagnetic spectrum. An exposition of the theoretical basis of the electromagnetic method for determining stress in anisotropic media is provided. Possibilities for applying this method to dynamic problems for anisotropic bodies are indicated. State-of-the-art implementation of the method is described. Functional diagrams of experimental devices are also provided, as well as results of the investigations.

The work is intended for the use of scientific and technical engineering personnel engaged in experimental investigations of the strength of solid deformable bodies.

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HANDBOOK OF SHIPBOARD RADIO COMMUNICATION AND RADIO NAVIGATION EQUIPMENT. VOL. 2: RADIO NAVIGATION EQUIPMENT

Leningrad SPRAVOCHNIK PO SUDOVOMU OBORUDOVANIYU RADIOSVYAZI I RADIONAVIGATSII. TOM 2: OBORUDOVANIYE RADIONAVIGATSII in Russian 1979 (signed to press 13 Nov 79) pp 2-4, 230-31

[Annotation, foreword and table of contents from book "Handbook of Shipboard Radio Communication and Radio Navigation Equipment", by Aleksandr Mustafovich Bayrashevskiy, Yuriy Yeliseyevich Gornostayev, Aleksandr Vasil'yevich Zherlakov, Aleksandr Anatol'yevich Il'in, Oleg Vasil'yevich Kononov and Nikolay Timofeyevich Nichiporenko, Izdatel'stvo "Sudostroyeniye", 12,000 copies, 232 pages]

[Text]

Annotation

The second volume of this handbook contains basic information on modern radio navigation and radar equipment for seagoing vessels. A classification of the devices is given along with their characteristics, and the makeup and composition of the equipment are given along with functional diagrams. The basic requirements for installing and operating the equipment under shipboard conditions are explained.

This handbook is intended for a wide group of engineering and technical workers in design organizations, as well as specialists who operate equipment aboard ships of the merchant marine and river fleets and the Ministry of the Fishing Industry.

This handbook can also be used by students of higher educational institutions and technical schools as well as students of marine training institutions in their course and graduation design.

Foreword

The requirements for navigational safety are increasing significantly in connection with the growth and tonnage and increases in the speed, size and inertia of modern vessels. The radio navigation instruments used aboard ships of the merchant marine and fishing industry fleets are extremely important. These instruments make it possible to reduce the number of accidents, which result in substantial material losses, and sometimes create a real threat to the environment.

Volume II of the Handbook on Shipboard Radio Communication and Radio Navigation Equipment is devoted to modern domestic radio navigation instruments used aboard ships of the merchant marine and fishing industry fleets. Examined here are functional and structural diagrams, operating and technical characteristics, and rules for technical operation of radio navigation instruments.

Chapter 1 examines shipboard radio direction finders with audible readout of the "Rybka" and "Barkas" type, and the type "Rumb" two-channel visual radio direction finder.

Chapter 2 contains a description of the types "Pirs-1D" and "Pirs-1M" receivers used to determine the location of the vessel by means of signals emitted by the shore stations of the "Dekka" phase radio navigation system.

Chapter 3 examines the type KPI-5F shipboard receiver, which is used to determine the location of the ship by means of signals from the shore stations of the pulse-phase "Loran-S" radio navigation system.

Chapters 4 and 5 provide descriptions of the type "Lotsiya", "Mius" and "Nayada" shipboard navigational RLS [radar stations] and type "Okean" and "Okean-M" automated navigational RLS.

Chapter 6 examines the operating features of the "Istra" navigational Doppler RLS for measuring docking speed.

Chapter 7 is devoted to the "Mgla" night-vision shipboard infrared equipment and the "Gorizont" television system.

Each chapter in the handbook is concluded with recommendations on the installation, mounting and operation of the radio navigation equipment in question aboard the ship.

The development of technical ship navigation equipment in the past ten years is characterized by the widespread introduction of digital computing technology and the use of new systems principles which increase the operational capabilities of instruments. The implementation of circuits for digital processing of radio navigation data makes it possible to use optimal processing methods and to represent navigational data in a form convenient for the navigator.

At the time work on the handbook was being finished, the development of the "Yenisey" radar set was completed and experimental operation had begun. The "Briz-Ye" and "Kron" computerized situation indicators are nearing completion, and production will begin in 1981. The more sophisticated "Biryusa" navigational set is now under development.

Unfortunately, none of these navigational sets are included in this issue of the Handbook. However, the authors have noted the trends in the development of technical ship navigation equipment, and have tried to provide a more thorough explanation of those questions which will help the reader to overcome difficulties in studying the radar-computing units not covered in the present Handbook.

This work was done by a collective of authors. Chapter 1 was written by O. V. Kononov, Chapter 2, by A. V. Zherlakov, Chapter 3 by Yu. Ye. Gornostayev, Chapters 4 and 6 by A. M. Bayrashevskiy, Chapters 5 and 7 by N. T. Nichiporenko, and Section 4.2 by A. A. Il'in.

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MEASUREMENT OF ELECTRIC POWER IN THE AUDIO FREQUENCY RANGE

Leningrad IZMERENIYE ELEKTRICHESKOY MOSHCHNOSTI V ZVUKOVOM DIAPAZONE CHASTOT in Russian 1980 (signed to press 25 Oct 80) pp 2, 166-7

[Annotation and table of contents from book "Measurement of Electric Power in the Audio Frequency Range", by Aleksandra Yakovlevna Bezikovich and Yefim Zinov'yevich Shapiro, Izdatel'stvo "Energiya", 5,900 copies, 168 pages]

[Text] This book examines modern methods and means of measuring the true power in alternating current circuits in the power and audio frequency ranges. Block diagrams are presented for analog and digital wattmeters and devices for calibrating power-measuring equipment. Information on this subject from domestic and foreign literature is likewise catalogued.

This book is intended for power-measurement specialists engaged in the development, production and operation of measurement equipment. It will also be useful for metrologists involved in the calibration of various types of power-measurement equipment and for students at higher education establishments of the electrical engineering professions.

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PRECISION DESIGN IN MICROELECTRONICS

Leningrad TOCHNOSTNYYE RASCHETY V MIKROELEKTRONIKE in Russian 1980 (signed to press 5 Feb 80) pp 2, 138-39

[Annotation and table of contents from book "Precision Design in Miroelectronics" by Anatoliy Semenovich Shumilin, Izdatel'stvo Leningradskogo universiteta, 3099 copies, 140 pages]

[Text] This book analyzes the requirements for the accuracy of the output parameter of the microelectronic device as a complex system and presents detailed studies on the influence of the instabilities of technological influences on its accuracy. The author examines the most popular variants of technological processes: vacuum-thermal: ion-plasma, and semiconductor processes. As a result of mathematical studies, the author found calculated relations for the most characteristic points of accuracy losses.

The book is intended for a broad section of readers and primarily for researchers and engineers working in the area of microelectronics, as well as for senior students in these areas.

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RELIABILITY OF MULTICHANNEL COMMUNICATIONS SYSTEMS

Moscow NADEZHNOST' SISTEM MNOGOKANAL'NOY SVYAZI in Russian 1980
(signed to press 20 Aug 80) pp 2, 94-95

[Annotation and table of contents from book "Reliability of Multichannel Communications Systems", by Ivan Ivanovich Gnidenko and Nikolay Parfent'yevich Truskalov, Izdatel'stvo "Svyaz'", 6000 copies, 96 pages]

[Text] Questions connected with determining the basic indicators of the reliability of primary system components and factors affecting the equipment during its production and use are discussed. Methods for designing and insuring reliability of the primary system, its equipment and transmission systems are described. Questions concerning inspection, preventive maintenance, organization of repairs and providing spare parts for electrocommunications offices are examined. Principles for designing systems for assembling information about the reliability of the equipment and installations of the primary system and methods for processing statistical data on their failures are presented.

The book is for specialists studying questions of reliability during planning, production and operation of multichannel communications systems, as well as for students of electrical engineering communications institutes.

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SYNTHESIS OF REDUNDANT DISCRETE SYSTEMS WITH STRUCTURAL RECONFIGURATION

Kiev SINTEZ IZBYTOCHNYKH DISKRETNYKH USTROYSTV S REKONFIGURATSIYEY STRUKTURY in Russian 1979 (signed to press 3 May 79) pp 2, 155-6

[Annotation and table of contents from the book "The Synthesis of Redundant Discrete Systems with Structural Reconfiguration", by Vadim Yevgen'yevich Obukhov and Vadim Vladimirovich Pavlov, Izdatel'stvo "Naukova dumka", 1500 copies, 156 pages]

[Text] This monograph constitutes an examination of the method which incorporates structure-reliability synthesis of redundant discrete systems (DS) subject to internal disturbances(failures). The method has its basis in the development of the prescriptive theory of dynamic systems as it applies to DS as a class. The applied body of mathematics provides the means for synthesis of redundant structures of diagnosible DS with continuous self-recovery of predetermined functional characteristics. Boolean functional equations of absolute invariance constitute the bases of this body of mathematics. A description of the DS reconfiguration method is given. Also provided is an overview of the synthesis of redundant diagnosible and autodiagnosible DS with adaptive recovery.

This book is intended for the use of scientific research workers and postgraduate students specializing in the field of computer technology, as well as for engineers involved in reliability design of discrete systems.

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THEORY AND CALCULATION OF OPTOELECTRONIC INSTRUMENTS

Moscow TEORIYA I RASCHET OPTIKO-ELEKTRONNYKH PRIBOROV in Russian 1980 pp 2-6

[Annotation and table of contents from book "Theory and Calculation of Optoelectronic Instruments", by Yu. G. Yakushenkov, Second edition, revised and supplemented, Izdatel'stvo "Sovetskoye radio", 392 pages]

[Text] The physical basics of optoelectronic instruments are presented. Typical components of the primary information processing system of an optoelectronic instrument are described: optical radiation sources and receivers, optical system, image analyzers, scanning systems and modulators. Basic attention is devoted to the calculation and selection of the parameters and characteristics of these components from the standpoint of optimum mating with each other and signal filtration on a background of interference.

Procedures are presented for calculating and selecting the most important parameters of optoelectronic instruments: range, precision, signal to noise ratio, design parameters and characteristics of sources, optical systems, receivers and electronic circuitry.

The book is intended as a textbook for students enrolled in optical courses at colleges and universities. It may also be beneficial to a wide range of specialists, engaged in optical instrument design and familiar with physics and electronics within the scope of the programs of general engineering institutions.

The text is accompanied by 86 figures, 23 tables and 131 bibliographic references.

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Part I. Physical Fundamentals and Elements of Optoelectronic Instruments

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THEORY OF CODE DIVISION OF SIGNALS

Moscow TEORIYA KODOVOGO RAZDELENIYA SIGNALOV in Russian 1980 (signed to press 3 Dec 80) pp 2-4, 207-8

[Annotation, excerpts from foreword and table of contents from book "Theory of Code Division of Signals", by Igor' Mikhaylovich Pyshkin, Izdatel'stvo "Svyaz'", 4,000 copies, 208 pages]

[Excerpts] This book presents the basis of the theory of code multiplexing and division of signals as applied to asynchronous address systems for the transmission of information. An analysis of the performance in terms of error probability for the most widely used types of asynchronous address systems is carried out for given models of interference. The synthesis and analysis of the best possible structures for processing signals in asynchronous address systems are also carried out. This book investigates performance in terms of error probability for nonparametric detectors and examines the feasibility of transmitting continuous traffic in asynchronous address systems using nonparametric modulation methods. This book likewise studies the use of code multiplexing and division of signals in practicable systems for the transmission of information.

This book is intended for engineering and technical workers in the field of data transmission.

Foreword

The networks and systems of data transmission that now exist or are in the design stage must insure simultaneous communications for a great many fixed and mobile installations randomly disposed over a given territory. As a result of this, multistation and multichannel data-transmission systems, the design of which requires a comprehensive approach, form the basis of future communications networks. Along with the multistation and multichannel capabilities of modern data-transmission systems, their basic features are:

- the transmission of both continuous and digital information on the same communication channels;

- the introduction of pulse modulation;

- the application of digital methods of shaping and processing signals;

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- the application of equipment based on digital integrated circuits.

Considering the overloading of the frequency range and the great cost of cable lines for the construction of multichannel and multistation systems, it is necessary to develop and introduce methods for multiplexing and dividing signals which make it possible to improve performance in terms of error probability and the traffic-handling capability of communication networks.

The development of new operating principles for multichannel and multistation systems should improve their traffic-handling capacity, increase their immunity to industrial interference and jamming and insure reliable operation under conditions of multipath radio-signal propagation and electromagnetic compatibility (EMC) of various radiotechnical systems.

All the positive characteristics of code multiplexing and division, based on the utilization of the redundancy of complex signals, manifest themselves most fully in asynchronous multistation data transmission systems or asynchronous address systems (AAS's). At the same time, the problems solved during the construction of AAS's extend beyond the scope of those problems relating to the analysis and synthesis of a specific system. The basic feature of AAS operation which distinguishes these systems from multistation systems with frequency and time-division of signals is the presence of structured interference, that is, interference whose wave form is coincident with the signal and which operates in the same band as the useful signal and which overlaps the signal with respect to time. The detection of a useful (working) signal of a given AAS subscriber is carried out against the background of signals (interfering signals) from the system's other subscribers. These signals overlap with respect to time and frequency. The influence of the interfering signals at the detector input of any of the system subscribers creates interference which can be approximated by a random process whose distribution density is essentially different from Gaussian. As a result of this, the optimum linear circuits for processing signals against a background of white Gaussian noise as well as the methods for the optimum processing of signals in the presence of correlated Gaussian noise gives unsatisfactory results in this case.

The main task for the theory of code multiplexing and division of signals is the task of "separating" the signals, that is, the selection of criteria and the discovery of algorithms that make it possible under the influence of non-Gaussian noise to detect and separate the useful signals and measure their parameters.

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TRANSMISSION OF IMAGES IN DIGITAL FORM

Moscow PEREDACHA IZOBRAZHENIY V TSIFROVOY FORME in Russian 1980 (signed to press 23 Jul 80) pp 3-4, 120

[Foreword and table of contents from book "Transmission of Images in Digital Form", by Boris Yevseyevich Trofimov and Oleg Valentinovich Kulikovskiy, Izdatel'stvo "Svyaz'", 5900 copies, 120 pages]

[Text] FOREWORD

The modern stage in the development of communications technology is characterized by the widespread introduction of digital image transmission systems. Such systems are more efficient than analog systems. The high efficiency of digital systems is explained by three factors: the possibility of regenerating the digital signals in intermediate and terminal equipment, the high technical and economic indicators of equipment for digital signal processing and correction and the possibility for using existing digital communications networks for transmission of television, video telephone and facsimilie images in digital form.

An almost total liberation of a digital signal from linear distortions and interference occurs in the regeneration process. This permits images to be transmitted over communications lines with a large number of regenerators over a distance which is practically unlimited. During transmission of television programs via Earth satellites and for digital image transmission from space it is possible to reduce the power of on-board transmitters as the result of digital encoding. Regeneration and encoding permit multiple re-recording of images and noticeably to improve the equipment indices which are used for correction of aperture and geometrical distortions, color control, combined image synthesis, analysis of initial images, conversion of signals from one standard to another and for other ends.

There are about 100 methods presently known for converting the analog signal of an image into a digital one. The extent of their suitability is determined by the concrete operating conditions of the system. All of the methods are based on one of the following types of modulation: pulse code (IKM), differential pulse code (DIKM) and delta modulation (DM). Moreover, the methods differ in the type of processing of the analog signal before analog-to-digital modulation and the type of subsequent processing of the initial digital signal. The properties of the image and of the visual analyzer are taken into consideration, which permits the maximal efficiency of the signal conversion process to be attained overall.

Recently several books and topical collections devoted to digital image transmission methods have been published in our country and abroad. Theoretical questions of conversion of images into digital form based primarily on IKM are examined in [1]. Certain theoretical aspects of orthogonal image conversion are examined in [2]. A number of articles of a review nature are published in [3-5]. A number of questions associated with conversion of television images into digital form have found reflection in [6].

In this book a description and analysis of the methods for analog-to-digital conversion of semitone images are given in systematized form, taking into consideration the peculiarities of their transmission via communication channels.

The authors acknowledge advice and critical remarks expressed by Prof. and Doctor of Technical Sciences N. B. Zeliger, honored scientist and technician of the RSFSR, Doctor of Technical Sciences Ye. L. Orlovskiy and Candidate of Technical Sciences A. G. Likiardopulo, and also the great task of reviewing and editing the book performed by V. S. Ignatkin and Candidate of Technical Sciences Yu. M. Braude-Zolotarev.

We ask that wishes and remarks concerning the book be directed to the "Svyaz'" publishing house at the address 101000, Moscow Chistoprudnyy Blvd., 2.

The Authors

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