24 JANUARY 1979 (FOUO 5/79) 1 OF 2

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JPRS L/8241

24 January 1979

USSR

TRANSLATIONS ON USSR SCIENCE AND TECHNOLOGY
PHYSICAL SCIENCES AND TECHNOLOGY
(FOUO 5/79)

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24 January 1979

TRANSLATIONS ON USSR SCIENCE AND TECHNOLOGY
PHYSICAL SCIENCES AND TECHNOLOGY

(FOUO 5/79)

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CYBERNETICS, COMPUTERS AND AUTOMATION TECHNOLOGY

ALL-UNION CONFERENCE ON TECHNOLOGY OF PROGRAMMING

Kiev KIBERNETIKA in Russian No 5, Sep/Oct 78 p 65

[Article by the Program Committee]

[Text] The Main Administration of Computer Technology and Control Systems of the USSR State Committee on Science and Technology, the Presidium of the Academy of Sciences Ukrainian SSR, and the Institute of Cybernetics of the Academy of Sciences Ukrainian SSR will hold the first All-Union Conference on "Technology of Programming" in Kiev during the second quarter of 1979.

The goal of the conference is to generalize existing methods of programming and to formulate recommendations for the industrial development of programs. The conference's Program Committee is planning a broad discussion of the problems of programming technology divided into the following sections:

1. Design methods which will insure high operating qualities--reliability, stability, proof of accuracy, etc.--in assembly systems [programmnyye sistemy];

2. Ways and means of controlling the production of assembly systems: organization of personnel, supervision, fixing labor norms, resource planning, training, price-setting, programmers' wages, legal relationships;

3. Architecture and software of modern electronic computers and their influence on the technology of programming by the broad masses of users;

4. Standards in programming. The technology of establishing library holdings of assembly systems and methods of utilizing them;

5. Program documentation and ways to produce it automatically;

6. Instrumental technological systems of programming;

7. The technology of preparation, verification, storage, and processing of data files;

8. Problems in organizing the operation of modern computer centers.

Those wishing to take part in the work of the conference must send summaries of their papers no more than one to two pages in length to the following address no later than 25 December 1978: 252207, Kiev, prospekt 40-letiya Oktyabrya, 142/144, IK AN UkSSR, Programmnyy komitet konferentsii "Tekhnologiya programmirovaniya." The summaries of the papers must be accompanied by the following general information: number of the section to which the paper belongs, last name, first name, patronymic (in full), academic degree, place of work, position of the author(s), and address for correspondence. Requests to change the wording of the sections proposed above or to add new ones should be communicated in writing. Questions may be addressed via telephone to I. V. Vel'bitskiy at 66-00-89 or 66-00-78.

Since the program for the conference will be drawn up from the contents of the summaries of the papers, general phrases should be avoided when writing them. Facts (qualitative analyses) and the substantive aspects of the report should be emphasized.

The Program Committee for the conference will communicate the results of its review of the summaries to the authors by 10 March 1979. Papers which are accepted by the Program Committee and put in the appropriate format will be published in the journals USiM [Upravlyayushchiye Sistemy i Mashiny], PROGRAMMIROVANIYE, and KIBERNETIKA.

CSO: 1870

CYBERNETICS, COMPUTERS AND AUTOMATION TECHNOLOGY

SYMPOSIUM ON ARTIFICIAL INTELLIGENCE, AUTOMATION OF MATHEMATICAL RESEARCH

Kiev KIBERNETIKA in Russian No 5, Sep/Oct 78 p 147

[Text] A Symposium on Artificial Intelligence and Automation of Mathematical Research will be held in Kiev on 14-16 November 1978 by the Institute of Cybernetics, USSR Academy of Sciences.

The symposium will be organized according to the following areas of research:

1) ways of automating mathematical research
2) methods of automatic search for corollaries
3) computations for mathematical proofs
4) methods for analyzing programs
5) special systems oriented to the processing of mathematical texts

It is planned to publish the materials from the symposium in issue No 2, 1979, of the journal KIBERNETIKA (Cybernetics), which will be devoted to results of the research on artificial intelligence being carried out within the framework of the Ukrainian Regional Council.

CSO: 1870

ELECTRONICS AND ELECTRICAL ENGINEERING

UDC 621.396.67

THE MUTUAL IMPEDANCE OF DIPOLE RADIATORS IN AN ANTENNA ARRAY WITH A MULTI-LAYER DIELECTRIC COVER

Kiev IZVESTIYA VUZ RADIOELEKTRONIKA in Russian Vol 21 No 7, 1978 pp 45-50

[Article by Ye.A. Steriopolo and G.T. Vas'ko, manuscript received 24 Sep 76, following revision 22 Aug 77]

[Text] A method of calculating the mutual impedance of the dipole radiators of an antenna array with a multi-layer dielectric cover is analyzed, where the cover is located in the near field of the dipoles. The method takes into account the influence of the currents induced in the fastening elements of the dipoles. Some calculation results are given.

Phased antenna arrays (FAR) frequently incorporate different kinds of dielectric covers, which play the part of antenna housings and are also used to improve the matching of the radiators. In this case, the cover is located in the near field of the radiators and can substantially change their interaction.

As a rule, the radiators in dipole FAR's are mounted above a conducting screen, as shown in Figure 1a, and the dipoles are driven by rigid coaxial feeders, which simultaneously play the part of posts which support the radiators at a specified spacing from the screen. The posts are likewise located in the near field of the dipoles, because of which, parasitic currents are induced in them which participate in the overall radiation of the FAR. The circumstances indicated here lead to the design configurations shown in Figure 1b, where the presence of the conducting screen of the FAR is taken into account in the form of a mirror image of the radiators and the dielectric covering them.

A problem close in nature was solved in [1], where the interaction of strip dipoles, pressed between flat dielectric layers, was treated. However, the results of [1] are not suitable for radiators positioned perpendicularly to the dielectric layer, where the currents in the support feeders are such as in this case. Given below is the derivation of formulas justified for both orientations of the dipoles, and some calculation results are presented.

The mutual impedance between two linear sources with an arbitrary distribution of the currents is described by the formula of [2]:

$$Z_{mn} = -\frac{1}{I_n^*(0)\, I_m(0)} \int_{\Gamma_n} E_m(u)\, I_n^*(u)\, du, \qquad (1)$$

where $I_n^*(u)$ is the current distribution in the n-th source; $E_m(u)$ is the field intensity produced by the m-th radiator at the surface of the n-th source; Λ_n is the resonance circuit used by the n-th current.

In accordance with Maxwell's equations, the field $E_m(u)$ can be written in terms of the vector potential $\vec{A}_m$ in the form:

$$\vec{E}_m = -i\omega\vec{A}_m + \frac{1}{i\omega\varepsilon}\,\mathrm{grad}\,\mathrm{div}\,\vec{A}_m, \qquad (2)$$

where

$$\vec{A}_m = \frac{1}{4\pi} \int_{\Gamma_m} \vec{I}(u)\left(\frac{e^{-ikr}}{r} + \psi_{\text{отр}}\right) du;$$

r is the distance between the point source and the observation point.

In the expression for the vector potential, the function ψ_{otp} [ψ_{ref}] describes the potential of the field reflected from the dielectric cover when a spherical wave e^{-ikr}/r falls on it. To find ψ_{ref}, we write the expansion of the spherical wave in terms of plain waves, something which permits the use of the well-known results concerning the reflection of any plain wave from a plain dielectric plate:

$$\frac{e^{ikr}}{r} = \frac{ik}{2\pi} \int_0^{\frac{\pi}{2}} \int_0^{2\pi} e^{i(k_x x + k_y y + k_z z)} \sin\Theta\, d\Theta\, d\varphi. \qquad (3)$$

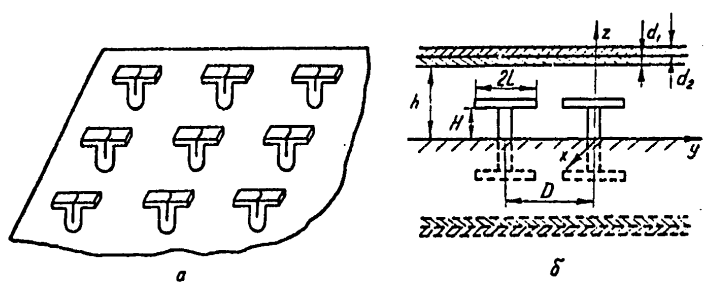


Figure 1. General view of the aperture of a dipole phased antenna array (a) and the configuration for calculating the mutual influence of the radiators(b) where a dielectric cover is present.

Considering the fact that each expansion wave of (3) is reflected from the dielectric having a coefficient of $U(\Theta)$, we obtain the function ψ_{ref} in the form [3]:

$$\psi_{\text{отр}} = \frac{ik}{2\pi} \int_0^{\frac{\pi}{2}} \int_0^{2\pi} e^{-i(k_x x + k_y y + k_z z)} U(\Theta) \sin\Theta \, d\Theta \, d\varphi =$$

$$= ik \int_0^{\frac{\pi}{2}} J_0 \left(k \sin\Theta \sqrt{x^2 + y^2}\right) e^{-ik(z+z_0)\cos\Theta} U(\Theta) \sin\Theta d\Theta, \tag{4}$$

where $J_0(k \sin\Theta \sqrt{x^2 + y^2})$ is a zero order Bessel function.

If the dielcetric cover is a multilayer one, then the resulting reflection coefficient $U(\Theta)$ assumes the form [3]:

$$U(\Theta) = \frac{Z^n_{\text{вх}} - W}{Z^n_{\text{вх}} + W}. \tag{5}$$

Here W is the impedance of free space, while Z^n_{BX} [Z^n_{in}] is the input impedance of cover, consisting of n layers. The quantity Z^n_{in} is found from the recurrent formula:

$$Z^n_{\text{вх}} = \frac{Z^{n-1}_{\text{вх}} - iZ_n \operatorname{tg}(k_{nz} d_n)}{Z_n - iZ^{n-1}_{\text{вх}} \operatorname{tg}(k_{nz} d_n)}, \tag{6}$$

where $Z_n = Z^0_n / \cos\Theta$ for perpendicular polarization of the incident wave;

$Z_n = Z^0_n \cos\Theta$ for parallel polarization; $Z^0_n = \sqrt{\mu_n/\varepsilon_n}$ is the characteristic impedance of the n-th layer.

Thus, the desired reflected field is found from formula (2) where expression (4) is substituted in it, taking into account (5) and (6). Considering the geometry of the antenna array (Figure 1b), the resonant circuit current in the radiators is expediently represented in the form of the sum of two linear currents: parallel and perpendicular to the dielectric cover. In this case, the problem of finding the reflected field is broken down into two simpler ones, in which it is necessary to find only one component of vector (2). Carrying out the differentiation, we obtain in the case of parallel current radiation:

$$E^x = -30i \int_{-L}^{L} I(x) \left\{ \frac{e^{-ikr}}{r} \left[\frac{k}{(120\pi)^2} + \frac{1}{kr^3} \tau(x - x', r) \right] - \right.$$

$$- \frac{e^{-ikr_1}}{r_1} \left[\frac{k}{(120\pi)^2} + \frac{1}{kr_1^3} \tau(x - x', r_1) \right] - 2ik \int_0^{\frac{\pi}{2}} U(\Theta) \sin\Theta \times$$

$$\times \cos(2kh\cos\Theta) \left[J_0(kr\sin\Theta)\, k \left(\sin^2\Theta (x - x')^2 \left(\frac{e^{2ikH\cos\Theta}}{r^2} - \frac{1}{r_1^2} \right) - \right.\right.$$

$$\left.\left.\left. - \frac{k^2}{(120\pi)^2} \left(e^{2ikH\cos\Theta} - 1\right) \right) + J_1(kr\sin\Theta) \sin\Theta \left(\frac{e^{2ikH\cos\Theta}}{r} - \frac{1}{r_1} \right) \right] d\Theta \right\} dx, \tag{7}$$

where где

$$\tau(x-x',r)=(x-x')^2\left(3ik-k^2r+\frac{3}{r}\right)-r(ikr+1);$$
$$r=\sqrt{(x-x')^2+D^2};\ r_1=\sqrt{(x-x')^2+D^2+4H^2};$$

D is the spacing between dipole centers; x' corresponds to the point source; x is the observation point.

For the case of perpendicular current radiation, the field E^z has the form:

$$E^z=-30i\int_{-L}^{L}I(x)\left\{\frac{e^{-ikr}}{kr^4}\tau(z-H,r)-\frac{e^{-ikr_1}}{kr_1^4}\tau(z+H,r_1)+\right.$$
$$+2k^2\int_0^{\frac{\pi}{2}}J_0(kr_0\sin\Theta)U(\Theta)e^{ikz\cos\Theta}\sin 2\Theta\cos\Theta\times \tag{8}$$
$$\left.\times\cos(2kh\cos\Theta)\sin(kH\cos\Theta)\,d\Theta\right\}dx,$$

where
$$r_1=\sqrt{(x-x')^2+D^2+(z-H)^2};\ r=\sqrt{(x-x')^2+D^2+(z+H)^2};$$
$$r_0=\sqrt{(x-x')^2+D^2}.$$

Formulas can be derived for the other components of the electrical intensity vector in a similar manner.

Formulas (7) and (8) are justified for an arbitrary current distribution in the radiators. In this case, the field is described by a double integral, something which requires rather voluminous calculations, particularly in the case of an antenna array with a large number of radiators. The calculations can be significantly simplified if we limit ourselves to the generally accepted model of a phased antenna array, i.e., we neglect the influence of the currents in the support features, and also take into account the fact that tuned dipoles are usually employed in the arrays, where the distribution of the currents in the dipoles is determined with high accuracy by the following sinusoidal function:

$$I(x)=I_0\frac{\sin k(L-|x|)}{\sin kL}. \tag{9}$$

Such a model is inadequate for an exhaustive description of the operation of array [4], but in the absence of "blind spots" in the radiation of an FAR element, it yields good practical results [5].

The field of the current (9) in free space takes the form of the superposition of three spherical waves, outgoing from the ends and the center of a dipole [2]:

$$E^z=-\frac{30iI_0}{\sin kL}\left(\frac{e^{-ikR_1}}{R_1}+\frac{e^{-ikR_2}}{R_2}-2\cos kL\frac{e^{-ikR_0}}{R_0}\right),$$

where где

$$R_1=\sqrt{(L-x)^2+D^2};\ R_2=\sqrt{(L+x)^2+D^2};\ R_0=\sqrt{x^2+D^2}. \tag{10}$$

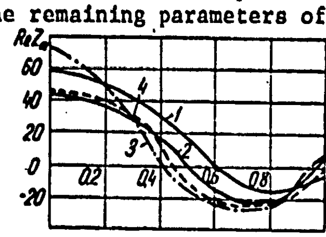
To find the wave reflected from the dielectric cover, one can use (3) - (6) without changes, in which case the result is the desired field directly, and not a Green function, something which eleminates the need of additional integration operations and differentiation thereafter.

In total, the complete field produced by the first dipole at the surface of the second dipole has the form

$$E_{12} = -\frac{30 I I_0}{\sin kL}\left\{\left(\frac{e^{-ikR_1}}{R_1} + \frac{e^{-ikR_2}}{R_2} - 2\cos kL\,\frac{e^{-ikR_0}}{R_0}\right) + \right.$$
$$+ 2ik\int_0^{\frac{\pi}{2}} [J_0(kR_1\sin\Theta) + J_0(kR_2\sin\Theta) -$$
$$\left. - 2ik\cos kL J_0(kR_0\sin\Theta)]\, U(\Theta)\, e^{-ikH\cos\Theta}\cos(k2h\cos\Theta)\sin\Theta d\Theta\right\}. \qquad (11)$$

Formula (11) contains only a single integral, and obviously, is significantly simpler than expressions (7) or (8).

Some of the results of calculations of the mutual impedances based on (1), (9) and (11) for the case of two parallel half-wave dipoles are shown in Figures 2a and 2b. The graphs depict the resistive and reactive components of the mutual impedance as a function of the spacing between the dipoles. The different curves correspond to the different thicknesses of the dielectric layer, the remaining parameters of which are chosen as: ε = 4.2, h = 0.276 λ.

(a) 

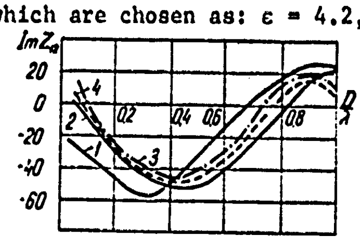
(b) 

Figure 2. The resistive (a) and reactive (b) components of the mutual impedance as a function of the spacing between dipoles:

1. d = 0.1λλ;
2. 0.04;
3. Without a dielectric;
4. 0.02.

For comparison, shown with the dashed-dotted line is the mutual impedance in the absence of a dielectric. It can be seen from the graphs of Figures 2a and 2b that with an increase in the thickness of the dielectric layer, the mutual impedances initially fall off, in which case the curves retain their character, and thereafter, beginning at a value of d = 0.04 λ, an opposite change is observed in the size of the mutual impedance, which is accompanied by a shift of the graph along the spacing axis.

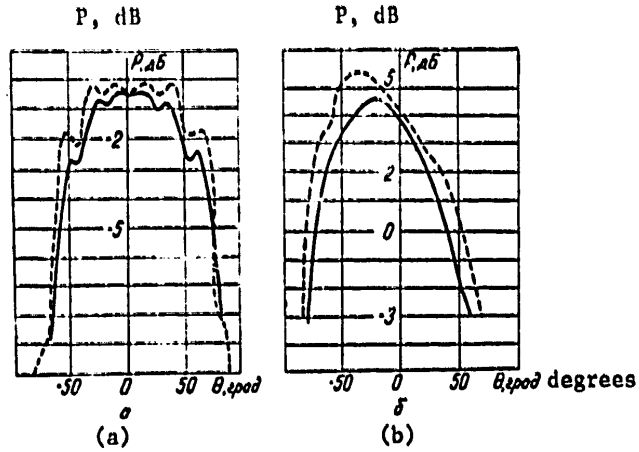


Figure 3. Partial directional patterns of the center (a) and end (b) radiators.

The degree of influence of the dielectric cover on the characteristics of a phased antenna array aperture can be assessed from the variation in the partial directional patterns of different radiators making up the FAR. Shown in Figures 3a and 3b are calculated patterns for the center and edge radiators, included in the complement of an aperture with a size of 11 x 11 dipoles. The directional patterns without a dielectric cover are indicated with a solid line, and with the cover, by a dashed line.

For these calculations, the dielectric cover was chosen in the form of a thin glass-textolite plate, with a thickness of d = 0.04 λ.

The dipoles in the array were positioned at the corners of a hexagonal grid with a spacing of 0.52 λ between the dipoles. The directional patterns were computed for the case of the excitation of one dipole of the array (the central or end one in the H-plane), taking into account the currents induced in all the remaining dipoles. The induced currents were found by means of numerically converting the mutual impedance matrix [2].

The graphs show that the shape of the partial directional patterns in the presence of a dielectric plate changes insignificantly, however, a different level is observed for the position of the directional pattern as a whole with respect to some particular common clamp. This circumstance gives evidence that thin dielectric plates can be successfully employed to match radiators while insignificantly distorting their radiation, something which confirms the well-known recommendations obtained experimentally [6].

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ELECTRONICS AND ELECTRICAL ENGINEERING

UDC 611.391.292

THE CALCULATION OF THE OPERATING CHARACTERISTICS OF A CHANNEL FOR PROTECTING AGAINST CROSSTALK INTERFERENCE IN A DOPPLER SPEED MEASUREMENT SET

Kiev IZVESTIYA VUZ RADIOELEKTRONIKA in Russian Vol 21 No 7, 1978 pp 84-87

[Article by A.A. Yeliseyev, V.N. Yakovlev, A.K. Yanovitskiy, N.G. Sokolov and G.G. Getmanenko, manuscript received 22 Feb 77, following revision, 9 Jan 78]

[Text] The operating detection characteristics of the timewise superposition of information signals at the input of an on-board speed measurement set are treated. Functional curves are plotted from the results of the analysis.

In radio electronic systems, operating in an asynchronous information exchange mode with a frequency on the order of several fractions of a Hertz, the measurement of the rate of travel of moving objects is accomplished using the Doppler shift of the signal frequency of the information transmission. The transmission itself takes the form of a sequence of radio pulses, the time position of which contains the exchange information. As a result of complete or partial timewise superposition of the radio pulses, caused by the overlapping of the signals at the system input, the instantaneous frequency of their additive mixture carries distorted information on the rate of motion, and the data of the metering channel should be eliminated from further processing.

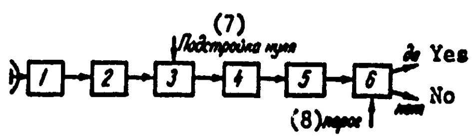

Figure 1.

Key: 7. Fine tuning to zero;
8. Threshold.

The most probable is the superpostion of two information transmissions, where this superposition is the basis for the entire subsequent analysis.

The configuration of the radio engineering system being studied is shown in Figure 1, where the receiving device 1 is understood to be the entire radio channel, operating in a linear gain mode. Full-wave rectifer 4 converts the bipolar video pulses incoming from the output of frequency discriminator 3 into unipolar ones and feeds them to adder-store 5 and then to threshold unit 6. It is assumed that by using "fine tuning to zero" of the frequency discriminator, the value of its transient frequency coincides with the value of the frequency of the radio pulses being received, which do not overlap in time the information pulse trains. Amplitude limiter 2 suppresses the amplitude modulation of the input signal mixture.

The presence of a multisection nonlinear channel precludes the possibility of using spectral-correlation analysis of the passage of the signals and noise through it, however, the assumption that there is no response lag in the processing channel permits the determination of the points in time of the random process at the output of the full-wave rectifier, while the adder-store brings the output process closer to a normal process where there is a rather large number of overlapping pulses at the system input.

It is difficult to use a one-dimensional probability density expression for the instantaneous frequency of the steady state normal random process [1] to write down the compostion of the laws governing the distribution of the instantaneous frequency of the additive mixture of the two information pulse trains in the internal noise of the receiver, and for this reason, it is expedient to make use of an approximating, one-dimensional normal probability density of the form [2]

$$W(\omega) = \frac{1}{\sqrt{\pi A}} \exp\left\{-\frac{(\omega-\omega_0)^2}{A}\right\}, \qquad (1)$$

where $A = 0.85\ \Delta\omega$; $\Delta\omega$ is the width of the power spectrum of the random process.

If the transient frequency of the discriminator is equal to ω_0, then by taking into account the laws governing the interaction of the instantaneous frequencies of the processes being added and the rules for the conversion of the probability densities for inertialless systems [1], one can derive the probability density for the instantaneous values of the voltage at its output in the following form

$$W(U) = \frac{1}{S\sqrt{2\pi[A(1-D)^2+BD^2+m^2\sigma_{\text{ш}}^2]}} \times$$
$$\times \exp\left\{-\frac{(U-S\Omega_{\text{д}}D)^2}{2S^2[A(1-D)^2+BD^2+m^2\sigma_{\text{ш}}^2]}\right\}. \qquad (2)$$

where $m^2 = (U_{\text{п}}^2/U_{\text{ш}}^2)\cos^2\varphi'$; $D = \sum_{n=1}^{\infty}(-1)^{n+1}k^n\cos n\varphi$;

U_π is the amplitude of the radio pulses at the input to the processing channel; $U_Ш$ [U_n] is the envelope of the noise voltage; $\sigma_Ш^2$ [σ_n^2] is the dispersion of the approximating distribution of the probability density for the instantaneous noise frequency; k is the ratio of the amplitudes of the overlapping radio pulses; ϕ is the difference in the instantaneous initial phases of the radio pulses being added; ϕ' is the difference in the instantaneous initial phases of the mixture of radio pulses and the noise voltage; S is the slope of the frequency discriminator characteristic; $\Omega_Д$ [Ω_d] is the Doppler frequency correction.

The first two initial points in time of the distribution of the instantaneous voltage values at the output of the full-wave rectifier with a transmission factor γ for the case of the joint action of two superimposed pulse trains or the action of one of them, are defined by the following expressions respectively:

$$\begin{gathered}
M_1[U']_{c+n}=\alpha\left\{\frac{1}{\sqrt{\pi}}\exp\left(-\frac{\beta^2}{\alpha^2}\right)+\frac{\beta}{\alpha}\left[2F\left(\frac{\beta}{\alpha}\sqrt{2}\right)-1\right]\right\},\\
M_2[U']_{c+n}=\alpha^2\left\{\frac{1}{2}-\frac{1}{\pi}\exp\left(-2\frac{\beta^2}{\alpha^2}\right)+\frac{\beta^2}{\alpha^2}4F\left(\frac{\beta}{\alpha}\sqrt{2}\right)\times\right.\\
\left.\times\left[1-F\left(\frac{\beta}{\alpha}\sqrt{2}\right)\right]-\frac{2}{\sqrt{\pi}}\frac{\beta}{\alpha}\exp\left(-\frac{\beta^2}{\alpha^2}\right)\left[2F\left(\frac{\beta}{\alpha}\sqrt{2}\right)-1\right]\right\},\\
M_1[U']=\frac{\alpha}{\sqrt{\pi}};\ M_2[U']=\frac{\alpha^2(\pi-2)}{2\pi},
\end{gathered}\tag{3}$$

where c + π is a subscript which indicates that the given point in time is associated with the case of the action of two pulse trains:

$$\alpha=2\gamma S\sqrt{\pi[A(1-D)^2+BD^2+m^2\sigma_Ш^2]},\quad \beta=\gamma S\Omega_Д|D|,$$

F_x is a Laplace integral.

The resulting moments of the distribution are random quantities because of the stochastical nature of the parameters α, β and m^2, which are included in them. For this reason, we shall first average the random parameters of the expressions (3) taking into account the laws governing the distribution of the random quantities included in them. The working characteristics which are subsequently plotted in this way, although they are not averaged in a strictly mathematical sense, they nonetheless physically yield weighted values of the correct detection probability [3]. Considering the fact that the fluctuating, superimposed radio pulses of the information pulses of the information pulse trains can have both coherent and random components, we shall make use of a Raysovskiy distribution of U_π. Only a random component is present in the composition of the internal noise, and consequently, U_n has a Rayleigh distribution.

1.

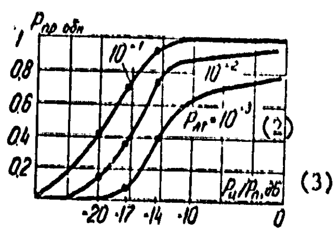

Figure 2.

Key: 1. Correct detection probability;
2. $P_{лт}$ = false alarm probability;
3. P_{target}/P_π, dB.

After deriving the truncated distribution for their ratios under conditions where the system operates in a finite range of the power ratio U_π^2/U_c^2, bounded by values of 0 -- q, we average the parameter m with respect to the random ratio U_π^2/U_n^2 and $\cos \phi'$:

$$\overline{m}^3 = \frac{\sigma_1^2}{2\sigma_n^2}\exp\left(-\frac{a^2}{2\sigma_2^2}\right)\left[\ln\left(1-q\frac{\sigma_2^2}{\sigma_1^2}\right)+\frac{1}{1+q\frac{\sigma_2^2}{\sigma_1^2}}-1\right] \qquad (4)$$

We also carry out similar averaging for the parameter β, assuming that the difference phase ϕ and the Doppler shift Ω_d of the received carrier have a uniform distribution in the corresponding intervals. We shall consider two cases for the coefficient k included in the expression for β:

a) A determinative signal component and a random interfering pulse train, the amplitude of which is governed by a Rayleigh distribution;
b) The amplitudes of the radio pulses of both pulse trains are random and have a Rayleigh distribution.

Omitting the intermediate transformations, one can derive:

$$\beta_а = \frac{2\pi-1}{2\pi^2}(\Omega_2-\Omega_1)\left\{2\sqrt{\pi}q\,[1-F(5q)]-\frac{1-\exp(-25q^2)}{5}\right\},$$

$$\beta_б = \frac{2\pi-1}{2\pi^2}(\Omega_2-\Omega_1)\left[\frac{10q^2}{1+25q^2}+q\,\mathrm{arc\,tg}\frac{1}{5q}\right],$$

where Ω_2 and Ω_1 are the maximum and minimum Doppler shifts of the carrier frequency respectively.

Taking into account the fact of the normalization of the voltage at the output of the adder-store, we obtain the following expression for the correct detection probability of the superpostion of the radio pulses of the pulse trains:

$$P_{cor.\ det.} = P_{пр\ обн} = 1 - F(U),$$

где

where $$U = \alpha(P_{лт})\left[\sqrt{\frac{\pi-2}{2\pi}}+\sqrt{\frac{L}{\pi}}-\sqrt{\frac{L}{2}}\frac{\beta}{\alpha^*}\right]; \qquad (5)$$

$\alpha^* = \frac{\alpha}{2\sqrt{S}}$; L is the number of pulses being added.

The working characteristics shown in Figure 2 for the following values of the parameters were computed from the relationships derived here:

$$L = 30;\ \overline{m}^2 = 2{,}6\cdot 10^{-2};\ \sigma_2^2/\sigma_1^2 = 10^4;$$

$$(\Omega_2 - \Omega_1)/\sqrt{A} = 12{,}5;\ \sigma_{\text{ш}}/\sqrt{A} = 71{,}5.$$

From the analysis given here, one can come to the conclusion that a detection channel for the timewise superposition of the [illegible] of pulse trains permits eliminating with a rather high probability the erroneous readings of velocity meter.

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ELECTRONICS AND ELECTRICAL ENGINEERING

UDC 621.317.765.8

A STANDARD MICROWAVE NOISE GENERATOR

Moscow IZMERITEL'NAYA TEKHNIKA in Russian No 8, Aug 78 pp 69-71

[Article by G. G. Petrosyan and L. P. Yemel'yanov]

[Text] Unit excess spectral noise power density (SPMSh) is reproduced by means of a device consisting of two thermal noise generators. The thermostat of one of these is maintained at a temperature $T_{hot} = 700°$ K, and that of the other at room temperature T_{cold}; the excess SPMSh produced by the device is then expressed by the formula

$$G = k(T_{hot} - T_{cold})\alpha$$

where k is the Boltzmann constant; and α is a coefficient which accounts for losses in the hot waveguide between the radiator and the output connector of the generator.

The overall error in reproduction of unit SPMSh consists of the following components:

d_1, the error in certification of the standard platinum thermocouple and the apparatus for measuring thermal EMF;

d_2, the error resulting from deterioration of the thermocouple in the period between certifications;

d_3, the error resulting from a difference between the radiator temperature and the temperature in the hot waveguide;

d_4, the error resulting from nonuniformity of temperature along the radiator;

d_5, the error resulting from a reflection coefficient greater than zero in the radiator;

d_6, the error resulting from instability of the temperature difference $T_{hot} - T_{cold}$ during the measurement period as a result of changes in room temperature and power supply voltage;

d_7, the error in determining the shape of the temperature distribution curve in the hot waveguide between the radiator and the load;

d_8, the error resulting from a difference between the temperature T_{cold} of the radiator and the generator output connectors and room temperature;

d_9, the error of determination of room temperature;

d_{10}, the error in determination of losses in a new cold waveguide;

d_{11}, the error resulting from change in losses in the cold waveguide as a result of deterioration of the material;

d_{12}, the error in determining changes in losses in the waveguide during heating to the temperature T_{hot}; and

d_{13}, the error of measurement of waveguide losses as a function of frequency.

In order to increase the accuracy of reproduction of unit SPMSh, we have constructed a new thermal generator device and have taken measures to decrease most components of the error.

In order to decrease errors d_1 and d_2, the thermocouples used in the thermal generators are certified at the same time, immediately before use, combining them into a single block for testing.

In order to decrease d_3, d_4 and d_5, the radiator is made of silicon, whose heat conductivity is close to that of metal. Silicon has a large loss tangent and a fine-grained structure, which makes it possible to decrease the radiator conditions considerably while improving its characteristics. The parameters of the KDB-10 silicon radiator are: wedge length, 70 mm; wedge width, 3 mm; $K_{stU} = 1.01$-1.03; hear conductivity, 100 W/m-deg; temperature variation along the wedge, ± 0.25° K. We give for comparison the parameters of a silicon carbide radiator: wedge length, 90 mm; wedge width, 23 mm; $K_{stU} = 1.05$-1.08; heat conductivity, 10 W/m-deg; temperature variation along the wedge, ± 1.0° K. Thus the thinness of the silicon sheet and its good thermal conductivity result in more even heating.

In order to decrease error d_6, the generators are of identical design and accordingly have identical drift, so that the temperature difference $T_{hot}-T_{cold}$ depends only slightly on the ambient temperature. In addition, because of the identical design the generators are interchangeable, making it possible to use them alternately at the high temperature.

In order to decrease d_8, an array of solid copper radiating plates with dimensions 180 x 180 x 7 mm are attached close to the output connections of the generators. In order to improve heat transmission between the waveguide and the radiating plates, a layer of KTP-8 heat-conducting paste is applied.

In order to decrease error d_{10}, losses in the hot and cold waveguides were measured by three methods with different sources of systematic error.

1. In the first method a "movable short" (Fig. 1) was used, with K_{stU} calculated from the breadth of the "double minimum" [1, 2]. In Fig. 1, 1 is a microwave generator in the modulation mode; 2 and 5 are decoupling isolators; 3 is a power regulator; 4 is a polarizing measuring attenuator; 6 is a decoupling attenuator with $K_{stU} \leq 1.03$; 7 is the measuring line; 8 is the waveguide under study, with the movable short; and 9 is a superheterodyne measuring receiver [3] or type V8-6 gage.

The measurement error resulting from the losses of the short itself was decreased by using a specially-constructed short with $K_{stU} \geq 1000$ [4], whose design is shown in Fig. 2. In the figure, 1 indicates cylindrical inserts 6.9 mm long (a quarter of the wavelength of the wave in the dialectric waveguide) made of flouroplastic; 2 indicates cylindrical brass insets 5.8 mm long (a quarter of the length of the wave in the dielectric coaxial line); 3 is the fluoroplastic plunger; and 4 is an absorbing plug of polyiron.

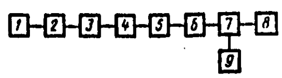

Fig. 1.

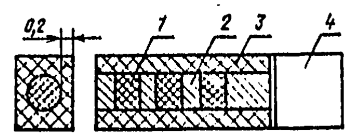

Fig. 2.

In order to decrease errors resulting from variation in the K_{stU} of the short, measurements were made at 400 points in the waveguide.

The measurement error resulting from losses in the connector between the measuring line and the waveguide was decreased by careful lapping of both contact surfaces of the flanges immediately before the measurements. The criterion of connector quality was the sinusoidal amplitude observed while measuring K_{stU} of the short at several successive positions in the waveguide.

In order to eliminate errors resulting from losses at the flange and in the measuring line, additional measurements were made by the "fixed probe" method. For this purpose, a 1-mm opening was drilled in the waveguide under study at a distance of 50 mm from the flange, and the measuring line probe was attached above it. The breadth of the "double minimum" was measured by a micrometer screw which was used to move the short; the probe was at a standing-wave minimum, which decreased the error resulting from shunting.

The error resulting from imprecision in manufacture of the polarizing attenuator used to "double" the minimum was decreased by careful calibration in the 0-70 dB range. The calibration was done in combination with the decoupling isolators; at the 70-dB point the error did not exceed ± 0.05 dB. During measurememts the attenuator was only used at the 0- and 3-dB points, where its error was negligibly small.

The remaining systematic error in the first method and in the apparatus used to implement it was $\theta_1 \leq \pm 0.006$ dB/m. The random error of measurement was $3\sigma_1/\sqrt{n} \leq \pm 0.002$ dB/m with n = 25.

2. The second method was direct measurement of induced losses: the waveguide was connected to a measuring circuit and removed from it [4].

In order to decrease the error resulting from imbalance, the waveguide length was chosen as an exact integral number of half waves; at the measurement frequency K_{stU} for the decoupling attenuators did not exceed 1.02.

The error resulting from losses in the additional connecting flange when the waveguide was connected into the circuit was not eliminated but corrected for; it amounted to -0.005 ± 0.003 dB.

The non-excluded systematic error of the second method and the hardware used to implement it was $\theta_2 \leq \pm 0.006$ dB/m (including the error resulting from the flange). The random measurement error was $3\sigma_2/\sqrt{n} \leq \pm 0{,}002$ dB/m with $n = 25$.

3. The third method of loss measurement was the "resonance" method. In addition to measurements using the system described in [5], additional measurements were made in which one of the resonator diaphragms was located within the waveguide under study. This made it possible to eliminate the error resulting from losses at the flange connection.

The remaining systematic error in the third method and the apparatus used to implement it was $\theta_3 \leq \pm 0.003$ dB/m; the random error was $3\sigma_3/\sqrt{n} \leq \pm 0{,}002$ dB/m with $n = 25$.

Measurements were conducted on three identical aluminum waveguides. Loss measurements were made at a frequency of 8,920 MHz ($\lambda_g \approx 50$ mm). The measurement results are shown graphically in Fig. 3. The abscissa gives the distance l from the short plane to the measuring line probe and the ordinate gives the loss N in the section of the waveguide between the probe and the short ($N = 8.68/k_{stU}$) [as published]. At first all three waveguides were studied without additional treatment. Their losses were identical and are shown in Fig. 3, line 1, which is drawn through the minima of an experimentally-determined sinusoid with an amplitude of 0.010 dB. Next one of the waveguides was heated to 700° K for 100 hours, while another was etched in an alkali bath for 5 days. The results of measurement of losses in both of these treated waveguides were identical (line 2, Fig, 3).

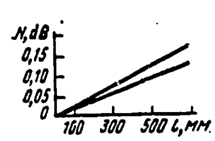

Fig. 3

It can be seen from the graph that the losses in the waveguide after treatment decreased: the cooling constant was 0.178 dB/m in the untreated waveguide and 0.158 dB/m in the treated one. Next, measurements of losses in the heated waveguide were made ten times at intervals of 100 hours of operation; the cooling constant remained at 0.158 dB/m.

The fact that heating and etching produced identical changes in losses leads to the hypothesis that the cause of the decrease is smoothing of microscopic surface irregularities. With a skin-layer thickness $\sim$ 1 micron and a height of irregularities $\sim$ 2 microns for the untreated waveguide, this hypotheses is quite possible.

The results of measurement of the cooling constant γ_i for the treated waveguides by three independent methods are practically identical:

the first method gives 0.158 dB/m, the second 0.157 dB/m (after correction for the flange), and the third 0.156 dB/m. The calculated value for the propagation constant was γ_o = 0.152 dB/m (with a direct-current resistivity of 2.6×10^{-6} ohm-cm for aluminum [6].

Close values of γ_i and γ_o, indicating identical resistivities to microwaves and to direct current for a 23 x 10 mm waveguide, were obtained by Morgan [7], where γ_i/γ_o = 1.01-1.03.

In order to decrease error d_{11}, the waveguides in the generators were manufactured of variety AMts aluminum, with a stable oxide which assures the long-term stability of electrical conductivity.

In order to decrease error d_{12} we determined the temperature coefficient of resistivity of the waveguide material by comparing losses in the waveguide under two conditions: with the temperature along the waveguide constant and equal to the room temperature, and with the temperature along the waveguide not constant but conforming to a function T(x) as shown in Fig. 4. The losses under both conditions were determined by the same method, measurement of the movable short located at a point corresponding to the thirtieth minimum of the standing wave field (the distance from the short was $\sim$ 650 mm). The measurement results were N_{cold} = 0.112 dB and N_{hot} = 153 dB.

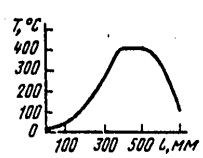

Fig. 4.

When the quantity N_{cold}, the dependence of the resistivity of aluminum on temperature for direct current (Fig. 5) and the function T(x) are known, we can calculate the losses in the hot waveguide: N_{hot} = 0.154 dB/m. The negligible difference between the experimental and calculated losses in the hot waveguide indicates that the functional dependence of resistivity on temperature is the same for microwaves as for direct current. This result is of considerable importance, since it frees the researcher from time-consuming microwave measurements and enables him to use data from handbooks based on direct-current measurements.

Thus the overall remaining systematic error of the generators was decreased to ± 0.003 dB, resulting in increased precision of the SPMSh standard.

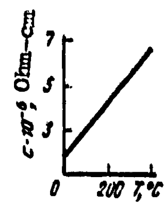

Fig. 5.

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GEOPHYSICS, ASTRONOMY AND SPACE

SALYUT 6 ORBITAL AND ATTITUDE CONTROL SYSTEM DESCRIBED

Paris AIR & COSMOS in French 9 Dec 78 pp 44-45

[Article by Serge Berg]

[Text] New information has been provided by the Soviet periodical AVIATZIA I KOSMONAUTIKA (No 11 of November 1978) concerning the orbital and attitude control system of the Salyut 6 Soviet orbiting station.

This system "Commences to operate as soon as the station is injected into terrestrial orbit in order to suppress the disordered motions of the station which occur when the Salyut 6 is separated from the booster rocket," states N. Pavlov, the article's author.

The system includes first of all, sensors (Figure 1) which are sensing elements of the station which determine its position in space relative to terrestrial or celestral reference points, as well as the angular velocities of the station's movements about the three axes whose origin is the station's center of gravity. In the case of Salyut 6 the X-axis is the longitudinal axis of the station, and the other two axes are perpendicular (Figure 2).

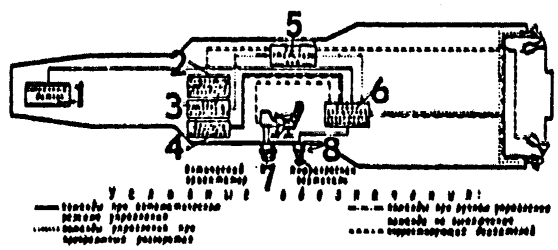

Figure 1. Orbital and altitude control system of the Salyut 6 orbiting station.

1. solar sensor
2. longitudinal acceleration integrator
3. free gyroscope unit
4. angular velocity sensors
5. stabilization unit
6. altitude motor control unit
7. optical sight unit
8. vertical indicator

Shown in continuous lines: flight regime controls; in dotted lines: programmed maneuver controls; in dot and dash lines: manual piloting controls; and in dash lines: altitude motor disconnection controls.

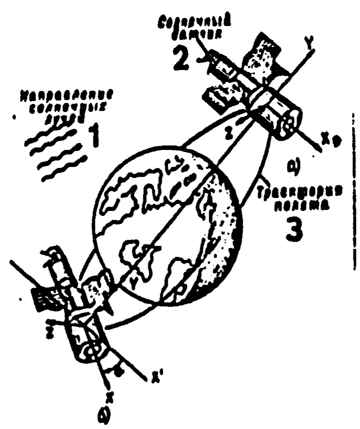

Figure 2. Orientation of the station in autonomous flight

(a) control by means of the IKV and solar sensor; (b) position of the station after a programmed orientation changing maneuver (by an angle α of the X-axis with respect to the initial position, X^1) 1. Direction of solar radiation 2. solar sensor 3. orbit of the station

The altitude of the station in space is determined by means of orientation sensors. The station is equipped, in particular, with an "infrared indicator of the vertical" (IKV); this sensor, fixed to the exterior of the Salyut 6 working cabin and directed along the Y-axis, is sensitive to infrared radiation emitted by the earth and its atmosphere. When the Y-axis deviates from the vertical the intensity of the received radiation varies, which produces deviation measuring signals serving to actuate the motors.

The orientation of the station upon the other axes is determined by a solar sensor and an "ionic sensor" (sensitive to the flux of ions in the atmosphere). It can also utilize an ensemble of "free gyroscopes" which in particular serve in programmed maneuvers, for example, to point the station in a given direction. The angular velocities of the station about the three axes are measured by sensors (velocity gyroscopes) located in the interior of the working cabin. The system also includes a "longitudinal acceleration integrator" utilizing a "heavy gyroscope" to limit the accelerations during maneuvers, as well as a "stabilization unit" to disconnect the motors when it is desired to modify the station's altitude.

The system also includes a logic for processing the data from the sensors upon the basis of which are elaborated the commands transmitted to the station's orientation and altitude motors which use liquid fuels from the same tanks. The motors operate continuously if the station must be rapidly maneuvered through a large angle, or in short impulses if the maneuvers are limited. The operation of the orbital and altitude control motors located on the exterior of the service module (at the rear of the station) is controlled by "the combined motor ensemble" (ODY). A group of motors enables the altitude of the station to be controlled or modified while two other motors (slightly inclined with respect to the X-axis) provide control and modification of the station's orbit. The motors of the Soyuz and Progress vehicles can also be used (as has already been done) to maneuver the station while conserving its fuel reserve.

The control of the station's orbit and altitude can be effected in accordance with three different modes: active stabilization in autonomous or manual flight regimes and passive stabilization by gravity gradient.

The autonomous flight regime (Figure 2) can use, for example, the IKV and the solar sensor. In such case the Y-axis is aligned upon the vertical and the Z-axis upon the sun (2a). Control is effectuated by means of the angular velocity sensors and the motor control unit. When the station is aligned along the Y-axis and Z-axis controls is effected by the free gyroscopes (2b). A velocity variation of 1 meter per second results in an altitude variation of 3 to 4 kilometers in the orbit at the antipode of the point of intervention. The station also has a "Cascade" automatic system which enables the station to be stabilized with precision during long periods with a minimum expenditure of fuel.

The manual flight regime (Figure 3) is utilized when the crew is aboard the station; it can be placed into operation from any of four command posts in the station. Thus, if the mission consists, for example, of photographing the earth, the cosmonaut maneuvers the station upon the three axes from command post No 1 by means of an optical sight unit. The pilot of the station has in front of him a grid screen which enables him to control the orientation upon the three axes: by means of a control lever he must produce the image of the earth upon the screen and keep it perfectly symmetrical with respect to the reference grid; this suffices to orient the station upon the vertical in place.

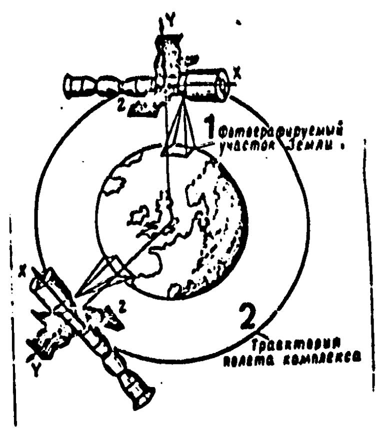

Figure 3. Stabilization upon the three axes of the Salyut 6-Soyuz combination. 1. photographic coverage 2. orbit

Stabilization by gravity gradient is utilized for certain experiments This stabilization method has the advantage of consuming no fuel at all. Once the longitudinal axis of the station is oriented upon the terrestrial verical (Figure 4) this position is automatically maintained by kinetic moments of the forces of return which bring the X-axis back to the vertical whenever the station deviates from it under the effects of various celestral and atmospheric peturbations.

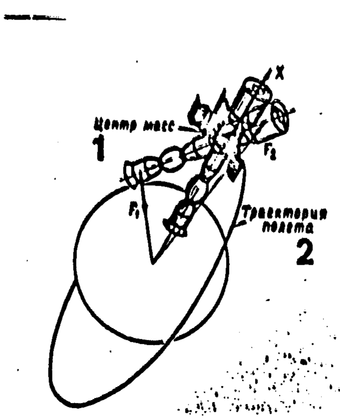

Figure 4. Stabilization by gravity gradient of the Salyut 6-Soyuz combination. The kinetic moments of the forces F1 and F2 automatically return the station to the terrestrial vertical. 1. Center of mass of the combination 2. Orbit.

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PHYSICS

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DYNAMIC HOLOGRAMS WITH STIMULATED LIGHT SCATTERING

Moscow DOKLADY AKADEMII NAUK SSSR in Russian Vol 243, No 3, 21 Nov 78 pp 630-633

[Article by A. I. Sokolovskaya and G. I. Brekhovskikh, Physics Institute imeni P. N. Lebedev, Academy of Sciences USSR, Moscow]

[Text] When laser emission passes through a liquid in which Raman scattering has been stimulated, self-focusing of the Raman-scattered light develops independently in the scattering substance alongside the self-focusing of the stimulating radiation. In Ref. 1 an investigation was made of the distribution of the field of stimulated Raman scattering in the scattering liquid close to the rear and front faces of the cell, and the distribution of the pumping field close to the front face. In all investigated cases, aggregates of regions of self-focusing of light were observed that were not identical to each other. Our studies showed that regions of self-focusing are also observed in a field of stimulated Mandelstam-Brillouin scattering.

According to existing concepts, the presence of regions of self-focusing should lead to distortion of the wave front of light emanating from a nonlinear medium, increasing divergence by many times, reducing brightness and changing the distribution of intensity of radiation. In contradiction to this it was shown in Ref. 1 that upon reaching the necessary density of pumping power and a certain thickness of the liquid layer, the "backscattered" stimulated Raman beam, in leaving the cell differed little from the pumping beam incident on the cell in the combination of such parameters as brightness, distribution of intensity and divergence. A comparison of the given parameters in the case of single-mode pumping in Ref. 1 showed that a nearly plane wave is restored on the wavelength of the "backscattered" Raman beam. By using this effect and retaining the experimental setup of Ref. 1 while introducing a three-dimensional transparency into the stimulating light beam, a volumetric image of the transparency was produced in the Raman-scattered light beam [Ref. 2]. It is interesting to note that the part of an object is also played by the end face of a ruby rod, the image in the case of stimulated Mandelstam-Brillouin scattering being located at the same distance from the cell as the ruby itself [Ref. 3], while in the case of Raman scattering it is shifted closer to the cell.

The purpose of this paper is to present experimental results showing that the position and transverse magnification of the volumetric image reconstructed in the case of stimulated scattering conform to the laws of holography, while the phase and amplitude distortions introduced into the light beams by the medium are compensated in the case of stimulated scattering of light propagating in the direction opposite to the stimulating emission -- "backwards."

The setup of the installation is analogous to that used in Ref. 1-2. The scattering was stimulated in liquid nitrogen, carbon disulfide, acetone and piperidine by means of a giant ruby laser pulse and the second harmonic of a neodymium laser. The frequency shift in the case of stimulated Raman scattering was 2330, 656, 2921 and 2940 cm^{-1} respectively. The three-dimensional object consisted of two grids separated by a certain distance and covering different parts of the pumping beam. The real images of the grids (Fig. 1, 1д, 2д) reconstructed in beams of "backscattered" Raman waves and stimulated Mandelstam-Brillouin scattering after the lens were experi-

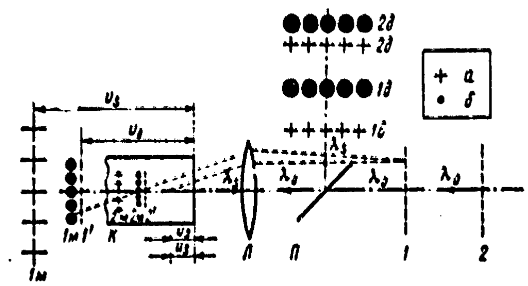

Fig. 1. Diagram of reconstruction of the image of an object with stimulated light scattering; 1, 2--transparencies of the grid, П--rotating glass plate, Л--lens, К--cell with scattering substance, λ_0, λ_s--stimulating and scattered radiation; 1', 2'--images obtained by means of lens Л in the pumping beam; 1м, 2м--imaginary images reconstructed with stimulated Mandelstam-Brillouin scattering (a) and stimulated Raman scattering (b); 1д, 2д--real images with stimulated Mandelstam-Brillouin and Raman scattering obtained by means of lens Л

mentally determined. The photographic plate was sequentially placed at different distances from the cell for registration of the best plane of focusing of real images. If the part of the beam leaving the cell is covered, we can convince ourselves that the real image of the object is formed in "backscattered" beams thanks to reconstruction in the scattered light of the beams diffracted on the edges of the grid wires. These reconstructed beams form distinct outlines of the cells (Fig. 2, right part). In this connection the inner fields of the cells remain unilluminated since they correspond to the light beam reconstructed in stimulated scattering after passing through the object without deflection. Knowing from the

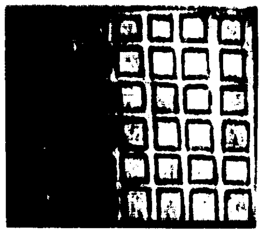

Fig. 2. Distribution of blackening on the photographic plate in the image plane of the object grid reconstructed with "backscattering"; the right part corresponds to the covered beam of stimulated Raman scattering

experiment the position and transverse dimensions of the real images (Fig. 1, 1∂, 2∂) on the wavelength of Raman and Mandelstam-Brillouin scattering, one can readily calculate from the lens formula the parameters of the corresponding imaginary images (1м, 2м) that are the sources, as it were, of the reconstructed waves. It was found that the image on the wavelength of stimulated Raman scattering is shifted relative to the image of the object in the pumping beam and altered in transverse scale, whereas the image for stimulated Mandelstam-Brillouin scattering practically coincides with the image of the object on the pumping wavelength, and has the same scale.

After calculating the spatial interference pattern of the pumping and the stimulated scattering leaving the cell for different positions of the object, we found that the magnification of the reconstructed image is always such that these interference patterns coincide close to the back face of the cell. We obtained expressions for the longitudinal and transverse magnification of images reconstructed with stimulated scattering [Ref. 4, 5]. Image reconstruction of an object with stimulated Raman "backscattering" and stimulated Mandelstam-Brillouin scattering is described by the formulas as if the hologram were standing at the location of the back (input for pumping and output for Raman "backscattering") aperture of the cell, and as if the reconstructing source were placed at the focus of the lens that focuses the pumping radiation into the medium. Actually, the experimental data are in good agreement with the formulas

$$v_s = \left(\frac{\mu}{v_0} + \frac{1-\mu}{u_0}\right)^{-1},$$
$$N = \left[1 + \frac{v_0}{u_0}\left(\frac{1}{\mu} - 1\right)\right]^{-1}, \qquad (1)$$

where u_0, v_0, v_s are the distances from the focus F, from the real image of the object (1', 2') on the pumping wavelength, and from the imaginary image of the object on the stimulated scattering wavelength (1м, 2м) respectively to the aperture of the cell (Fig. 1), $\mu = \lambda_s/\lambda_0$. Formulas (1) are analogous to those that describe image reconstruction by means of a hologram [Ref. 6].

The location of the plane of the hologram close to the outlet aperture of the cell implies that displacement of the back aperture of the cell relative to the pumping interference pattern should lead to a change in magnification of the object reconstructed with stimulated Raman "backscattering," whereas for stimulated Mandelstam-Brillouin scattering the magnification is always close to unity (see (1)). Our experimental measurements showed that the magnification and shift of the image with displacement of the cell are in good agreement with the theoretical values. Thanks to the possibility of wide variation of the wavelength of the scattered emission, it is with stimulated Raman scattering that we can demonstrate satisfaction of the principal laws of holography for images reconstructed with stimulated scattering.

The thickness of the layer in which the interference patterns of stimulated scattering and pumping can coincide is determined by the wavelength of stimulated scattering and the distance between the sources of interfering waves. If the object is placed close to the focus of the lens, and consequently the distance between the sources is great, the thickness of the layer of coincident interference patterns (e. g. stimulated Raman scattering of nitrogen) does not exceed 1 mm. Coincidence of the interference patterns of stimulated scattering and pumping in such a thin layer shows that the stimulated scattering beams that form the image of the object cannot arise only as a result of amplification of stimulated scattering in the maxima of the pumping interference pattern. It is natural to assume that these beams arise as a result of diffraction of the stimulated scattering wave whose imaginary source coincides with the focus of lens Л in the plane of the output aperture of the cell on amplitude [Ref. 7] and phase holograms. Phase holograms in the medium may arise in connection with the change in the index of refraction of the substance due to the Kerr effect, electrostriction and so forth [Ref. 4, 8, 9]. Reconstruction of a sharp image of the object with stimulated Raman scattering having magnification and position corresponding to coincidence of the interference patterns of the stimulating and scattered light only in the plane of the output aperture of the cell shows that in any other planes inside the cell there is no effective diffraction that leads to reconstruction of images with spatial position and magnification corresponding to these planes. The theory developed in Ref. 10 needs radical re-examination. The absence of effective diffraction inside the cell, as shown by our studies, is associated with amplitude and phase distortions of the pumping beam as it passes through a nonlinear medium [Ref. 1, 11]. The extent of the distortions depends on the intensity of the pumping beam.

In the case of "forward" stimulated Raman scattering as opposed to "backscattering," the image of the object was reconstructed only when the real image (1) in the pumping beam was located outside of the cell with the scattering medium. The uncertainty in the position of the reconstructed image in space within limits of 30 mm, as opposed to stimulated Raman "backscattering," where this uncertainty is less than 5 mm, shows that in the case of "forward" stimulated Raman scattering there is no single plane of the hologram within the medium where the interference pattern of the pumping beam is most effectively reconstructed. A comparison of results with "forward" stimulated Raman scattering, stimulated Raman "backscattering" and stimulated Mandelstam-Brillouin scattering showed that in the latter two cases there is nearly total compensation of static and dynamic inhomogeneities in the medium. For instance the sharpness of the image reconstructed with stimulated Mandelstam-Brillouin scattering is just as good as that of the image on the pumping wavelength without the scattering liquid. However, our studies showed that when the threshold of stimulated scattering is considerably surpassed the effect of reconstruction may be disrupted as a consequence of self-focusing of the stimulated scattering light. There are optimum values of the coefficient of amplification and the size of the nonlinear contribution to the index of refraction where reconstruction of the wavefront is fairly effective, while self-focusing of stimulated scattering does not yet disrupt the effect of reconstruction.

In discussing the way that the characteristics of beams of stimulated Raman scattered light depend on the parameters of the stimulating laser emission, one should not confuse the effect of wavefront reconstruction in stimulated Raman scattering with the effect of "repetitions" [Ref. 10] since the discussion in Ref. 10 was in application to the relation of spectral width and angular directionality of "forward" stimulated Raman scattering and the unshifted component after the scattering substance, and no consideration is given to problems of the phase relations in the stimulating light beam preceding the substance with the phase relations in the stimulated Raman scattering beams.

Reconstruction of the three-dimensional image of the object and the identical reconstruction of the wave front with stimulated scattering is the only effect that is common to stimulated Raman and Mandelstam-Brillouin scattering [Ref. 11]. In the special case of equality of the wavelengths of the reference and reconstructing beams, reconstruction of the wavefront of the light in the "backward" direction denotes its inversion: rays of the reconstructed light beam coincide with rays of the beam incident on the cell in different directions. For stimulated Raman scattering the longitudinal and transverse magnification differs appreciably from unity, the Raman scattered rays and pumping rays do not coincide, although this difference is smaller than in the case of reflection from a mirror [Ref. 2]. The images of the object that are reconstructed with stimulated Raman "backscattering" and stimulated Mandelstam-Brillouin scattering are displaced relative to one another and have different scales. For an object located close to a lens, its image, and in particular the image of a glass plate etched in hydrofluoric acid [Ref. 12] is shifted by 5-10 cm for the investigated media. The fact that the data found for stimulated Raman scattering under the given conditions are identical to the data found for stimulated Mandelstam-Brillouin scattering shows that the method used in Ref. 12 is unsuitable for studying reconstruction of a wavefront in stimulated Raman scattering. In a strict sense, the concept of wavefront inversion is not applicable to stimulated Raman scattering.

The results of our work show that in addition to the dynamic holograms obtained by menas of nonlinear crystals and dye solutions [Ref. 8, 13], with stimulated scattering of light one can also get volumetric images of three-dimensional objects that conform to the laws of holography.

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SCIENTISTS AND SCIENTIFIC ORGANIZATIONS

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COOPERATION WITH SCIENTIFIC ESTABLISHMENTS OF THE SOCIALIST COUNTRIES

Moscow VESTNIK AKADEMII NAUK SSSR in Russian No 9, Sep 78 pp 120-129

[Article by A. A. Kulakov, chief of the External Relations Administration, Presidium of the USSR Academy of Sciences: "USSR Academy of Sciences -- International Cooperation in 1977: I. Cooperation With Scientific Establishments of the Socialist Countries"]

[Text] The Soviet Union's vigorous foreign policy, the successes of Soviet science and its growing prestige throughout the world are promoting the expansion and strengthening of our country's international scientific ties. Cooperation among the scientific establishments of the socialist nations is developing particularly rapidly, based on the principles of proletarian internationalism, supported by ideological unity, political solidarity, accelerating economic integration and the mighty production potential of the brother nations.

In 1977 the USSR Academy of Sciences, embodying the plans specified at the historic 25th CPSU Congress and guided by the decisions of CPSU Central Committee plenums and speeches by CPSU Central Committee General Secretary L. I. Brezhnev, Chairman of the Presidium of the USSR Supreme Soviet, devoted constant attention to development of ties with the academies of sciences and other scientific establishments of the socialist countries, as well as improvement in the forms of cooperation and improvement in its effectiveness.

The year 1977 was marked by an important event for our country and the entire world socialist system -- celebration of the 60th anniversary of the Great October Socialist Revolution. The Academy of Sciences and the scientific community of the socialist nations extensively honored this important date. Official meetings were dedicated to discussion of the great contribution made by the scientific establishments and scientists of the Soviet Union toward the genesis and development of science in the brother countries and the successes achieved as a result of the joint efforts of the scientists of the socialist community. Twenty-three USSR Academy of Sciences displays were exhibited in Bulgaria, Vietnam, the GDR, the Democratic People's Republic of Korea, Mongolia, Poland, Czechoslovakia, and Yugoslavia. Four and a half million visitors to these exhibits became acquainted with the achievements of our science in the area of space exploration, quantum electronics, solid-state physics, scientific instrument engineering, computer technology, archeology, and the development of metallopolymers.

Delegations of the academies of sciences of the socialist nations took part in a jubilee session of the General Assembly of the USSR Academy of Sciences, in an international theoretical conference on the topic "The Great October Revolution and the Contemporary Era," in an all-union scientific-theoretical conference on the topic "Historical Experience of the CPSU in the Campaign for Peace and Friendship Among Peoples," and in conferences on the topics "The Great October Socialist Revolution and the National Liberation Movement of the Peoples of Asia, Africa and Latin America," "The Great October Revolution and the Literary Process of the Contemporary Era," and "The Great October Socialist Revolution and the Nationalities Question."

Participation by the USSR Academy of Sciences in Multilateral Cooperation

In 1977 the USSR Academy of Sciences and the academies of sciences of the union republics actively participated in implementation of long-term cooperation plans and programs: a comprehensive program for further deepening and improvement of cooperation and development of socialist economic integration of the CEMA member nations; a coordinated plan of multilateral integration measures in the area of science and technology for the period 1976-1980; a consolidated plan of cooperation by the CEMA member nations in performing scientific and technical research of mutual interest, for the period 1976-1980; programs of multilateral cooperation among the academies of sciences of the socialist countries for the period 1976-1980. The USSR Academy of Sciences sent to the socialist countries more than 5,000 Soviet scientists for the conduct of joint research and participation in scientific and scientific-organizational measures on the basis of multilateral and bilateral cooperation plans, international and national congresses, conferences, and symposia, and accepted an equal number of scientists from these countries to its scientific establishments.

An important role in development of multilateral cooperation was played by a conference of presidents of academies of sciences of the socialist countries, held in Moscow in February 1977. The conferees focused primary attention on increasing the effectiveness of scientific research and further development of cooperation in the area of the social sciences. Academy officials were received by CPSU Central Committee General Secretary L. I. Brezhnev. In the course of the discussion there was an exchange of views on development of cooperation among the academies of sciences of the brother nations, further enhancement of the role of science in accomplishing the tasks of building socialism and communism, and on the role of the scientists of the socialist nations in the campaign to strengthen world peace.[1]

In 1977 the academies of sciences of the socialist nations cooperated in working on 18 problems, including 118 topics in the area of the natural sciences and technology, and 80 topics in the area of the social sciences.

At a conference held in Sofia in March, representatives of problem commissions on the natural sciences discussed ways to improve organizational forms of cooperation. Recommendations were adopted on determining the most important topic areas for cooperation, on reducing the number of organizational measures, strengthening ties between problem commissions and CEMA agencies, and on speeding up practical adoption of scientific results.

Pursuant to these recommendations, effective contacts were established in particular between problem commissions and the corresponding coordination centers of the CEMA member nations on the problems "High-Molecular Compounds," "Kinetics and Catalysis," and "Planning and Management of the Economy of the CEMA Member Nations."

In the area of the natural sciences, researchers proceeded from simple coordination of scientific research to international division of labor. A new form of cooperation has become widespread: organization of base laboratories, which in the future can serve as a base for forming international scientific teams.

The activities of three international centers for upgrading qualifications of scientific cadres have continued: the S. Banach Mathematics Center (Polish People's Republic), centers on problems of heat and mass exchange (USSR) and on electron microscopy (GDR), as well as an International Laboratory of Strong Magnetic Fields and Low Temperatures (Polish People's Republic) and an International Information System for the Social Sciences.

The 10th Conference of Representatives of the Academies of Sciences of the Socialist Nations was held in Sofia in November. A delegation from the USSR Academy of Sciences took active part in the conference; the delegation was headed by Chief Scientific Secretary of the Presidium of the USSR Academy of Sciences Corresponding Member of the USSR Academy of Sciences G. K. Skryabin. Academician Yu. V. Bromley presented a paper entitled "The Great October Socialist Revolution and Implementation of the Leninist Nationalities Policy in the USSR."

The report of the Bulgarian Academy of Sciences -- cooperation coordinator for the period 1976-1977 -- gave good marks to the problem commissions headed by Soviet scientists, the International Center for Heat and Mass Exchange in Minsk, the International Information System for the Social Sciences (coordinator--INION [Institute of Scientific Information for the Social Sciences] of the USSR Academy of Sciences), and participation by scientific establishments of the USSR Academy of Sciences in the work of other problem commissions. Representatives of the USSR Academy of Sciences informed the conferees on progress in implementing the recommendations of the conference of presidents of academies of sciences.

At the proposal of the USSR Academy of Sciences, a recommendation was adopted on elaboration of a long-term program of multilateral cooperation in the area of the natural sciences.

The USSR Academy of Sciences proposed holding the next, 11th Conference of Representatives of Academies of Sciences in Moscow in 1979, and in connection with this assumed the duties of coordinator for 1978-1979.

Cooperation among the social scientists of the socialist nations developed extremely vigorously in 1977. A long-term program of multilateral cooperation in the area of the social sciences, discussed at the Second Conference of Vice-Presidents and at a conference of presidents of the academies of sciences of the socialist nations, was included as a component part of the Program of Multilateral Cooperation for 1976-1980.

Joint work continued on seven problems of the social sciences included in the program, on problems under the topics "Study of European Security," "Slavic Linguistic Atlas" and several others, as well as cooperation within the framework of the International Information System for the Social Sciences (MISON).

The multilateral cooperation division of the Scientific Cooperation with Socialist Countries Administration of the USSR Academy Sciences, with the participation of the Council on International Cooperation in the Area of the Social Sciences of the USSR Academy of Sciences, held in April an annual conference of representatives of Soviet components of problem commissions in the area of the social sciences. Topics discussed included the tasks of the commissions in the area of implementing the long-term program of multilateral cooperation among the scientific establishments of the socialist nations in the area of the social sciences.

The problem commissions devoted considerable attention to preparation for and conduct of jubilee events dedicated to the 60th anniversary of the Great October Socialist Revolution. A jubilee collected volume of articles was published within the framework of MISON, entitled "60-letiye Velikoy Oktyabr'skoy sotsialisticheskoy revolyutsii" [60th Anniversary of the Great October Socialist Revolution], containing articles by leading Soviet scientists and scientists from other socialist countries dealing with important problems of Marxist historiography of the October Revolution and its influence on the world historical process. A problem commission was established, to handle the topic "The World Socialist System," and preparations were made for the constituent session of the problem commission "Patterns of Development of World Literature."

A conference was held in Moscow in October, gathering together representatives of scientific establishments of the socialist countries, on preparation for publication of a mass scientific-popular work entitled "Kratkaya istoriya vtoroy mirovoy voyny 1939-1945 gg." [A Concise History of World War II, 1939-1945]. The membership of the international editorial board and the publication plan were approved.

Scientific establishments of the USSR Academy of Sciences and the academies of sciences of the union republics took active part in programs of scientific cooperation within the framework of CEMA. The following coordination centers established under the auspices of academy scientific establishments continued operations: "Research in the Area of Biological Physics" (USSR Academy of Sciences Institute of Biophysics); "Study of Chemical, Physical, Biological and Other Processes of the Major Regions of the World Ocean" (USSR Academy of Sciences Institute of Oceanology); "Development of New Industrial Catalysts" (Institute of Catalysis of the Siberian Department of the USSR Academy of Sciences); "Development of the Scientific Principles and Elaboration of New Industrial Processes of Welding, Surfacing and Thermal Cutting of Various Materials and Alloys" (Ukrainian SSR Academy of Sciences Institute of Electric Welding), and "Group of Scientific Research and Experimental-Design Projects Requisite for Developing Gaseous, Liquid and Solid Fuel MHD Electric Power Stations" (USSR Academy of Sciences Institute of High Temperatures). Regular meetings of councils of representatives and scientific-technical councils on all these problems were held: coordinated proposals were drafted on utilization of the obtained results and on deepening specialization and cooperative efforts in research.

A list of problems of the coordinated plan of multilateral integration measures by the CEMA member nations for 1976-1980 was drawn up, which contained 17 major scientific-technical problems.

Considerable attention was focused on mutual exchange of scientific and technical information, increasing the qualifications of scientific cadres, organization of joint consultations, schools and symposia; information bulletins were published. The "Welding" coordination center, jointly with the International Scientific-Technical Information Center, published a catalogue of welding equipment which is series-manufactured in the CEMA member nations.

The USSR Academy of Sciences Institute of High Temperatures, in conformity with the resolutions of the 21st Session of the CEMA Executive Committee and the 17th Session of the CEMA Committee on Scientific and Technical Cooperation, drafted a long-term specific program of cooperation up to 1990 on the problem "Complex of Scientific Research and Experimental-Design Projects Requisite for Developing MHD Electric Power Stations." The draft plan was discussed at the Second Session of the Cou[illegible] of Representatives on this problem (October, Bulgaria).

Considerable work was performed by scientific establishments of the USSR Academy of Sciences on the problems "Malignant Tumors," "Elaboration of the Scientific Principles of Ergonomic Standards and Requirements," "Protection of Ecosystems (Biogeocenoses)," and "Socioeconomic and Organizational-Legal Aspects of Nature Conservation."

Bilateral working plans have been drawn up and agreements on exchange of specialists have been signed within the framework of the working group on automation systems for planning-design and engineering in the branches of industry and construction.

Scientists of the USSR Academy of Sciences are members of many agencies of the CEMA committee on scientific and technical cooperation and are participating in creation and operation of the International Scientific and Technical Information System and in scientific projects of the CEMA permanent commissions on geology, agriculture, utilization of atomic energy for peaceful purposes, and on standardization.

USSR Academy of Sciences Bilateral Cooperation With Scientific Establishments of the Socialist Countries

In 1977 scientific establishments of the USSR Academy of Sciences and the academies of sciences of the union republics did a good deal of work on carrying out five-year problem-topic plans of scientific cooperation with the academies of sciences of the brother nations.

Scientific cooperation between the USSR Academy of Sciences and the Bulgarian Academy of Sciences was conducted in conformity with the Protocol on Scientific Cooperation Between the USSR Academy of Sciences and Bulgarian Academy of Sciences for 1976-1980 and the Problem-Topic Plan for 1976-1980, which specifies joint efforts on 62 problems of the natural and social sciences.

Ties between Soviet and Bulgarian physicists have become strengthened. A delegation of Soviet scientists headed by Academician A. M. Prokhorov visited Bulgaria in September on the invitation of the Bulgarian Academy of Sciences. Delegation members visited establishments of the Bulgarian Academy of Sciences, Sofia University, the Ministry of Electronics and Electrical Engineering of the People's Republic of Bulgaria, exchanged work experience with their Bulgarian colleagues, and presented their observations and recommendations on development of physics in Bulgaria. A regular meeting of the Commission of Historians of the USSR and the People's Republic of Bulgaria and a scientific session dedicated to the centennial of the Russian-Turkish war and the liberation of Bulgaria from the Ottoman yoke were held in Kishinev in April. A representative delegation of Bulgarian scholars was headed by Academician D. Kosev, Vice-President of the Bulgarian Academy of Sciences and member of the Central Committee of the Bulgarian Communist Party.

Scientific establishments of the Bulgarian Academy of Sciences widely celebrated the 60th anniversary of the Great October Socialist Revolution. The Bulgarian Academy of Sciences held a scientific session entitled "The Great October Socialist Revolution and Its Influence on Development of Social Progress," which included participation by a delegation from the USSR Academy of Sciences, headed by Academician N. V. Mel'nikov, member of the Presidium of the USSR Academy of Sciences.

Scientific cooperation between the USSR Academy of Sciences and the Hungarian Academy of Sciences was carried out in conformity with the Protocol and problem-topic plan for scientific cooperation in 1976-1980. The plan specifies joint efforts by institutes of the USSR Academy of Sciences and Hungarian Academy of Sciences on 36 problems in the natural and social sciences.

The Bilateral Commission of the USSR Academy of Sciences and the Hungarian Academy of Sciences on Solid-State Physics successfully coordinated joint scientific research in the area of solid-state physics and quantum electronics. The current session of the Soviet-Hungarian Commission on Cooperation in the Social Sciences (September, Hungarian People's Republic) was an important event. The commission discussed the results of execution of the Consolidated Problem-Topic Plan for Scientific Cooperation in the Area of the Social Sciences and noted successful work by Soviet and Hungarian scholars on the majority of the joint research topics. Academician P. N. Fedoseyev, leader of the Soviet delegation, was received by Comrade J. Kadar, First Secretary of the Central Committee of the Hungarian Socialist Workers' Party, who gave high praise for the work done by the commission. The need for all-out deepening of ties between Soviet and Hungarian social scientists was emphasized.

There was continued publication of Soviet-Hungarian journals: four issues of the journal PROBLEMY UPRAVLENIYA I TEORII INFORMATSII [Problems of Control and Information Theory] were published, as well as two volumes (eight issues) of the journal SOOBSHCHENIYA PO KINETIKE I KATALIZU [Reports on Kinetics and Catalysis], and four issues of the journal MATEMATICHESKIY ANALIZ [Mathematical Analysis].

The Hungarian Academy of Sciences officially honored the 60th anniversary of the Great October Socialist Revolution. A scientific session of the General Assembly of the Hungarian Academy of Sciences, dedicated to this important date, was held in October. Participants at the session included a delegation from the USSR Academy of Sciences, headed by Academician A. M. Prokhorov, member of the Presidium of the USSR Academy of Sciences.

Scientific ties between the USSR Academy of Sciences, the State Science and Technology Committee of the Socialist Republic of Vietnam and the Social Sciences Committee of the Socialist Republic of Vietnam were implemented in conformity with the Protocol on Scientific Cooperation Between the USSR Academy of Sciences, the State Science and Technology Committee and Social Sciences Committee of the Socialist Republic of Vietnam in 1975-1977.

Completion of construction in Hanoi of the Combined Scientific Research Institute, erected by Vietnamese organizations on the plans and with the assistance of the USSR Academy of Sciences, was an important event. A delegation from the USSR Academy of Sciences, which included vice-presidents of the USSR Academy of Sciences Academicians P. N. Fedoseyev and A. V. Sidorenko, Academician A. A. Dorodnitsyn, and Corresponding Member of the USSR Academy of Sciences O. T. Bogomolov, took part in the festive events dedicated to the official opening of the Combined Scientific Research Institute. At the same time preliminary talks were held on further development of scientific cooperation between the AS USSR and scientific establishments of the SRV.

A protocol was signed in Moscow in November on scientific cooperation in the period 1978-1979 between the AS USSR on the one hand and the Scientific

Research Center and Social Sciences Committee of the SRV on the other.

Scientific cooperation between the AS USSR and the Academy of Sciences of the GDR developed pursuant to the Protocol and Problem-Topic Plan for Scientific Cooperation in 1976-1980 on 59 problems in the natural and social sciences.

A conference of scientist-experts of the AS USSR and GDR was held in Berlin in April, at which results of cooperative efforts in 1975-1976 were summarized, and working plans for scientific cooperation in 1977-1978 were coordinated.

A conference of experts from the AS USSR and AS GDR was held in Novosibirsk in May, dedicated to cooperation in the area of the biological sciences. In particular, it was noted that cooperation is becoming increasingly diversified: an exchange of information, reagents and preparations is taking place, and joint publications and reports are being published. For example, in 1975-1976 journals in the USSR and the GDR as well as international journals published more than 50 joint papers produced by scientists of the USSR and GDR, and more than 20 joint papers were presented at conferences.

The Commission of Historians of the USSR and GDR marked its 20th anniversary in 1977. In connection with this anniversary, Comrade E. Honecker, General Secretary of the Central Committee of the Socialist Unity Party of Germany, sent to the commission members a message of greetings in which he highly praised its activities and expressed thanks "for the scientific contribution toward research on and publicity of the progressive and humane traditions of our peoples, the revolutionary traditions of the worker movement of our countries, and the traditions of the fighting alliance between the Socialist Unity Party of Germany and the CPSU."

This commission's 26th Scientific Conference was held in Berlin in September, on the topic "The Great October Socialist Revolution and the World Revolutionary Process."

The Seventh Scientific Session of the Commission of Philosophers of the USSR and the GDR was held in Kiev in May. One of the meetings was dedicated to the 60th anniversary of the Great October Socialist Revolution and the development of Marxist-Leninist philosophy in the post-October era. In the course of the session a symposium was organized, on the topic "Dialectics of Development of the Socialist Society," and a progress report was presented on preparation of a joint study entitled "Marxist-Leninist Teaching on Ideology and Philosophical Problems of the Contemporary Ideological Struggle."

The Third Scientific Session of the Commission of Economists of the USSR and GDR, on the topic "Economic and Social Problems of Scientific and Technological Progress and Changes in the Social and Economic Structure of the Developed Socialist Society" (December, Moscow), was conducted on a high theoretical and methodological level. Preparations were completed for a joint monograph entitled "Scientific and Technological Progress and the Socialist Economy."

Literary scholars of the AS USSR and AS GDR completed work on a collective study entitled "Under the Badge of Unity. On the Development of a World Literature of Socialist Realism, 1917-1945."

Scientific establishments of the AS GDR widely celebrated the 60th anniversary of the Great October Socialist Revolution. Scientific colloquia were held with the participation of Soviet scientists, and the results of socialist competition in honor of this important date were summarized. Officials, party and trade union organizations of scientific establishments of the AS GDR sent congratulatory letters to their partner-institutes of the AS USSR.

Scientific ties between the USSR Academy of Science and Academy of Science of the Democratic People's Republic of Korea developed pursuant to the plan of scientific cooperation between the two academies for 1976-1977.

The USSR Academy of Sciences sent two geologists to the DPRK to study the tectonics of sedimentary and deep-lying strata of the earth's crust and upper mantle in the World Ocean, and a botanist to familiarize himself with the work of botanical gardens, forest-park and park development in the DPRK.

Four Korean specialists in technology of peat extraction and utilization and wood chemistry and three specialists in satellite observation were sent for training to the USSR Academy of Sciences. Five Korean scientists took part in conferences held by the USSR Academy of Sciences.

Cooperation between the USSR Academy of Sciences and the Academy of Sciences of the Republic of Cuba took place pursuant to a five-year program of cooperation between the two academies. In May 1977 a delegation from the USSR Academy of Sciences, headed by Academician V. A. Kotel'nikov, Vice-President of the AS USSR, visited Cuba and held talks with officials of the Cuban Academy of Sciences. A plan of cooperation in the area of the natural sciences for 1977-1978 was signed. Joint projects will be conducted on 14 problems in computer technology, astronomy, geophysics, physics, chemistry, marine biology, botany, zoology, geography, geology, oceanography, scientific information, and other fields.

Meetings dedicated to the 60th anniversary of the Great October Revolution were held at scientific establishments of the Cuban Academy of Sciences.

Scientific cooperation between the USSR Academy of Sciences and the Academy of Sciences of the Mongolian People's Republic was conducted pursuant to the Plan of Scientific Cooperation between the AS USSR and AS MPR for 1976-1980.

As in previous years, joint expeditions -- geological, paleontological, biological, historical-cultural -- continued active operations.

A joint Soviet-Mongolian scientific research geological expedition succeeded in substantiating the existence in the southern part of Mongolia of volcanoplutonic rocks containing carbonatites. A model of the structure of the earth's crust and upper mantle to a depth of 120-140 km has been constructed for Central Mongolia. Three volumes of expedition results have been published. A scientific conference and exhibit entitled "Principal Accomplishments of the Expedition in the Last 10 Years" were held in Ulan-Bator in September.

A joint Soviet-Mongolian paleontological expedition obtained unique materials from Mesozoic and Cenozoic continental sediments, which are of great significance for solving problems of Cretaceous and Paleogene biostratigraphy in Mongolia. Representative collections of marine invertebrates (trilobites, brachiopods, corals, bryozoans, etc) were gathered for study of the paleontology, biostratigraphy and paleogeography of Mongolia's ancient landmass.

A joint Soviet-Mongolian combined biological expedition organized a new permanent facility in an ultraarid desert environment -- the first facility of its type in Central Asia. Work is in progress on four other permanent facilities in all of Mongolia's natural zones. Proposals were drafted on protection of wild ungulates in the MPR.

A Soviet-Mongolian historical-cultural expedition continued field research activities. Dozens of new monuments of Mongolia's antiquity were discovered and examined; the obtained scientific results are making it possible to solve many key problems of Mongolia's ancient and medieval history.

Joint projects were also being conducted on many problems of astronomy, mathematics, physics, chemistry, history, economics, law, literature, and language.

The MPR Academy of Sciences extensively celebrated the 60th anniversary of the Great October Socialist Revolution; meetings were held at the Presidium of the Academy of Sciences and at scientific establishments.

Scientific cooperation between the USSR Academy of Sciences and the Polish Academy of Sciences was conducted pursuant to the protocol and problem-topic plan for scientific cooperation between the AS USSR and the PAS in 1975-1980 which specifies the conduct of joint projects or coordination of research on 54 problems in the natural and social sciences.

"Soviet Science and Technology Days" were held in Poland in April, with the participation of a representative delegation from the AS USSR, which included Academician G. I. Marchuk, Vice-President of the AS USSR, Academicians

A. G. Aganbegyan, N. G. Basov, S. V. Vonsovskiy, V. M. Glushkov, R. Z. Sagdeyev, V. D. Sadovskiy, V. I. Spitsyn, and corresponding members of the AS USSR N. A. Vatolin, Ye. M. Savitskiy and M. A. Sergeyev.

A commission of historians of the USSR and Polish People's Republic held a conference in Moscow on the topic "Historical Significance of the Great October Socialist Revolution. Changes in the Structure of the Worker Class of the USSR and PPR in the Process of Building Socialism and Communism." A collected volume of joint articles was published, entitled "Kul'turnyye svyazi narodov vostochnoy Yevropy v XVI v." [Cultural Ties of the Peoples of Eastern Europe in the 16th Century], and a collected volume entitled "Russia, Poland and the Black Sea Coast Area in the 16th-17th Centuries" was prepared.

A commission of philosophers of the USSR and PPR readied for publication the proceedings of the Second Session of the Commission "Tasks and Development Prospects of Marxist-Leninist Philosophy in the USSR and PPR in Light of the Resolutions of the 25th CPSU Congress and Seventh Congress of the Polish United Workers Party." A regular meeting of the commission of economists of the USSR and PRP was held in Warsaw, as was a theoretical conference on the problems of development of relationships of socialist property and improvement in management of the national economy.

Numerous events were held at establishments of the Polish Academy of Sciences dedicated to the 60th anniversary of the Great October Socialist Revolution. A scientific conference on the topic "Influence of the Great October Socialist Revolution on Revolutionary Processes in the Contemporary World" was held in Warsaw in November. The conference was attended by a delegation from the AS USSR led by Academician I. I. Mints, who presented a paper entitled "The World-Historic Experience of the Great October Socialist Revolution."

Scientific cooperation between the USSR Academy of Sciences, the Academy of the Socialist Republic of Romania and the Academy of Social and Political Sciences of the SRR was carried out pursuant to a protocol covering the period 1976-1980.

In connection with the earthquake on 4 March 1977, a group of seismologists from the Institute of Earth Physics of the AS USSR was sent to Romania. The USSR Academy of Sciences supplied the Romanians with earthquake-recording instruments and auxiliary equipment.

Attaching great importance to the development of scientific cooperation between Soviet and Romanian scientists in the area of the social sciences, in November the USSR Academy of Sciences invited for discussion of these matters the president of the SRR Academy of Social and Political Sciences, M. Georghiu, and General Secretary C. Ionescu.

The bilateral Soviet-Romanian Commission of Historians continued its activities. A regular commission meeting was held in Bucharest in December on the topic "The Historical Experience of the October Revolution and Building the Foundations of Socialism in Romania."

Scientific cooperation between the USSR Academy of Sciences and the Czechoslovak Academy of Sciences was conducted pursuant to the Protocol and Problem-Topic Plan of Scientific Cooperation Between the USSR AS and Czechoslovak AS for 1976-1980, on 38 problems of the natural and social sciences.

Bilateral problem commissions continued their activities. Reports on topics of cooperation in the last two years were discussed and concrete areas of research for the period 1978-1980 were designated at meetings of the Soviet-Czechoslovak commissions on high-molecular compounds (Kiev) and single crystals (Leningrad). A conference of a team of experts from the USSR Academy of Sciences and the Czechoslovak Academy of Sciences on the problem "Plasma Physics and Physics of Elementary Particles," held in Prague, summarized progress made by scientific establishments of the USSR AS and Czechoslovak AS in 1976-1977 and agreed on a working plan for 1978. A regular session of the Commission of Historians of the USSR and Czechoslovakia was held in Prague.

The AS USSR Institute of Geology of Ore Bodies, Petrography, Mineralogy and Geochemistry, jointly with the geological institutes of the Czechoslovak and Slovak academies of sciences, published a volume of collected articles entitled "Opyt korrelyatsii magmaticheskikh i metamorficheskikh porod Chekhoslovakii i nekotorykh rayonov SSSR" [Tentative Correlation of Magmatic and Metamorphic Rocks of Czechoslovakia and Some Areas of the USSR] -- the first substantial work presenting a comparative study of magmatic and metamorphic rocks of mobile belts and areas of ancient consolidation on the territory of the two countries. This study is of great significance for establishing the fundamental patterns of evolution of the earth's crust and upper mantle and for mineral prospecting.

The USSR Academy of Sciences and the Czechoslovak Academy of Sciences held their regular awards ceremony honoring the best joint research projects by Soviet and Czechoslovak scientists.

Czechoslovak scientists extensively celebrated the 60th anniversary of the Great October Socialist Revolution. A general meeting of the Czechoslovak Academy of Sciences was held, dedicated to this important date. The meeting was attended by a delegation from the USSR Academy of Sciences, led by Academician A. V. Sidorenko, Vice-President of the USSR Academy of Sciences.

Scientific cooperation between the USSR Academy of Sciences and the Council of the Academies of Sciences and Arts of the Socialist Federated Republic of Yugoslavia was carried out pursuant to a protocol covering the period 1976-1980 and a problem-topic plan specifying joint research on 35 problems of the natural and social sciences.

During talks between delegations of the USSR Academy of Sciences and the Council of Academies of Sciences and Arts of the SFRY held in Moscow in May, the subject matter of joint research was specified, and the scope of scientist exchange in 1977 was determined.

Thus in 1977 cooperation among the academies of sciences of the socialist nations continued to develop on a stable, organized basis. Scientific-organizational measures conducted by the academies were directed toward improving organizational forms of cooperation, increasing the effectiveness of joint research and unifying the efforts of scientists for solving important scientific and technical problems. Expansion and strengthening of scientific cooperation constitutes an important contribution of the academies of sciences, scientific establishments, and scientists of the USSR and the other socialist countries toward development of the world socialist system and toward strengthening its unity and solidarity.

FOOTNOTE

1. For more detail on the conference of presidents of the academies of sciences of the socialist countries, see VESTNIK AN SSSR, No 5, 1977, pp 5-70.

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SCIENTISTS AND SCIENTIFIC ORGANIZATIONS

UDC: 001.89 (100)

ACADEMY OF SCIENCES SCIENTIFIC COOPERATION WITH SCIENTISTS IN CAPITALIST AND DEVELOPING COUNTRIES

Moscow VESTNIK AKADEMII NAUK SSSR in Russian No 10, Oct 78 pp 112-124

[Article by A. A. Kulakov, chief of the External Relations Administration, Presidium of the USSR Academy of Sciences: "USSR Academy of Sciences -- International Cooperation in 1977: II. Cooperation With Scientific Establishments in Capitalist and Developing Countries"*]

[Text] The principles of peaceful coexistence of nations with differing social systems were proclaimed by the Soviet Republic on the very first day of its existence. In the historic resolutions of the 24th and 25th CPSU Congresses these principles were reflected in the Peace Program and the Program for Further Struggle for Peace and International Cooperation, for the Freedom and Independence of Peoples. These principles are playing an increasingly important role in international affairs; their influence encompasses the entire aggregate of international relations of nations, including the international ties of the USSR Academy of Sciences with scientific establishments in capitalist and developing countries. These relations experienced further development in 1977.

International ties of the USSR Academy of Sciences were effected on the basis of 30 agreements and protocols concluded with scientific organizations in capitalist and developing countries, as well as 50 intergovernmental agreements, programs and protocols on cultural, scientific or scientific-technical cooperation.

In 1977 approximately 2,500 scientists and specialists from scientific establishments of the USSR Academy of Sciences visited capitalist and developing countries, and an equal number of scientists and specialists from these countries visited our academic establishments.

Soviet scientists took part in the activities of many important foreign scientific forums, including the Congress of the International Federation of Information Processing (Canada); the Fifth International Congress of

* The first part of A. A. Kulakov's article appears in VESTNIK, No 9.

Economists -- "Economic Growth and Resources" (Japan); the 18th General Conference of the International Union for Study of Population Problems (Mexico); the 10th Congress of the World Energy Conference (Turkey); the Assembly of the International Association of Biochemistry and Space Chemistry (France); the 27th International Conference of the Physiological Sciences (France); the 20th International Limnological Congress (Denmark); the 11th Conference of the Federation of European Biochemical Societies (Denmark); the 12th International Hegel Congress (Austria); the 12th International Congress of Linguists (Austria); the 15th International Congress on the History of Science (Great Britain); the General Assembly of the International Union of Social Sciences (France), plus other scientific forums.

In turn scientists from 33 capitalist and developing countries attended many congresses, conferences and symposia organized by the USSR Academy of Sciences. These scientific forums included the 8th International Congress on Organic Geochemistry (Moscow); the 11th Congress of the Carpatho-Balkan Geological Association (Kiev); the International Symposium on Proteins, Polypeptides and Amino Acids of the Brain (Yerevan); an international symposium entitled "Philosophy and Social Progress" (Moscow); the Fourth International Conference on Ferroelectricity (Leningrad); the Seventh International Conference on Atomic Collisions in a Solid Body (Moscow); a symposium of the International Astronomical Union on the topic "Structure of the Universe and the Forming of Galaxies" (Tallin); a conference of European information and documentation centers in the area of the social sciences (Moscow), plus others.

An important place in the system of international ties of the USSR Academy of Sciences is occupied by cooperation with U.S. scientific establishments. This cooperation is carried out both on the basis of agreements between the USSR Academy of Sciences and U.S. scientific establishments and on the basis of intergovernmental agreements.

The U.S. National Academy of Sciences is one of the principal partners of he the USSR Academy of Sciences. In 1977 both academies continued active cooperation on coordinated projects and programs dealing with the problems of extremely long-base radiointerferometry, solid-state physics, new areas in biology, experimental psychology, and ion implantation in semiconductors. New joint programs were specified last year: comprehensive study of promising inorganic materials, and study of defects in solids.

Joint work within the framework of the intergovernmental program of cooperation experienced further development, particularly in the area of physics, chemical catalysis, MHD energy conversion, politics of science, and environmental protection.

The second session of the intergovernmental Soviet-American commission on cooperation in the field of energy (Moscow, December 1977) noted effective work by Soviet and American scientists in the area of MHD energy conversion, and stated that last year work was completed on preparation of a joint basic study on the technical and economic aspects of MHD energy conversion.

The Soviet-American working group "Stimulation of Development of Basic Research" completed an exchange of materials on systems of fostering basic scientific research in the USSR and the United States and proceeded with preparing publications on this subject. In July-August 1977 a seminar was held in Aspen, Colorado for the research group on joint elaboration of problems of theoretical physics, entitled "Frontiers of Solid-State Theory." A seminar on cosmic X-Ray sources was held in August in Protvino (USSR). Joint work continued on a number of projects in the area of study of the World Ocean and environmental protection.

A program of exchange of scientists in the social sciences, specified by an agreement between the USSR Academy of Sciences and the American Council of Learned Societies (ACLS), was successfully carried out. The second joint session of the USSR AS and ACLS Commission on Cooperation in the Social Sciences was held in Moscow in 1977. There also occurred meetings of international economists, specialists on Asia problems, ethnographers, historians, and psychologists. A program was coordinated on joint research in the area of international relations, economics, history, sociology, law, psychology, literature, ethnography and anthropology. More than 500 scientists and specialists from the AS USSR visited the United States in 1977, and more than 700 American scientists visited our academy establishments.

Of great importance for further development of cooperation with the scientific establishments of Great Britain was signing of an agreement on exchange of scientists in the area of the social sciences between the USSR Academy of Sciences and the British Academy of Sciences, as well as a visit to the USSR by a delegation from the London Royal Society, led by its president, Lord A. Todd (September 1977). During this visit a new agreement was signed, on scientific cooperation and exchange of scientists between the AS USSR and the Royal Society.

A third meeting of civic leaders, representatives of science, culture and business from the USSR and Great Britain was held in London in November 1977, at which current political and economic problems of Anglo-Soviet relations, European and world politics were discussed.

The Sixth Session of the Joint Anglo-Soviet Commission on Scientific and Technical Cooperation was held in Moscow in May, at which was noted the usefulness of scientific ties (involving the participation of the AS USSR) in the field of radio astronomy, structural crystallography, synchrotron radiation, heat and mass exchange, protection of metals against corrosion, friction, wear and lubrication. New areas of scientific cooperation were specified -- electron optics, optoelectronics, and control of complex systems.

A total of 167 scientists and specialists from the AS USSR visited Great Britain in 1977, while 220 British scientists and specialists visited academy establishments in the Soviet Union.

In the course of cooperation between the USSR Academy of Sciences and French scientific establishments in 1977, principal attention was focused on honoring the pledges specified in the program for expanding Soviet-French contacts in the area of science and technology over a 10-year period. The principal areas of this cooperation include space exploration, studies in the area of controlled thermonuclear synthesis, low-temperature physics, semiconductor physics, chemical catalysis, chemical physics, the physico-chemical principles of life, information science, scientific instrument engineering, synchrotron radiation, quantum electronics, and nonlinear optics.

The Fourth Session of the Working Group on Cooperation in the Area of Scientific Instrument Engineering was held in September 1977, at which progress on joint projects was discussed, and plans for further cooperation were outlined. That same month a bilateral symposium entitled "Physico-chemical Principles of Life" was held in Tashkent. A meeting of specialists participating in work on the topic "Dynamics of Interaction Between the Natural Environment and Prehistoric Societies" was held in France in September, at which problems of paleography and archeology of the Lower and Middle Pleistocene in France were discussed.

There was continued cooperation between scientists at the Institute of Petrochemical Synthesis imeni A. V. Topchiyev of the AS USSR and the French companies (Ron-Pulenk) Industries and Air-Liquide on the topic "Research on the Medical and Industrial Application of Polyvinyltrimethylsilane Film," as well as with the French Petroleum Institute on motor fuel additives.

In conformity with the quota of the protocol of the Mixed Commission on Scientific and Technical Cooperation, in 1977 the AS USSR sent 72 scientists to France and received 109 French scientists. On the basis of the exchange specified by an agreement between the USSR Academy of Sciences and the National Center for Scientific Research, 21 Soviet scientists visited France, and 28 French scientists visited academy scientific establishments.

Scientific ties with scientists of the FRG were effected last year both on the basis of an agreement between the USSR Academy of Sciences and the German Scientific Research Society in Bonn (NNIO), and on the basis of separate agreements on joint projects.

Joint research continued in the field of Messbauer spectroscopy, heliomagnetic and ionospheric observations. The Third Symposium on gamma-resonance spectroscopy was held in Yerevan in October 1977. The first phase of the large-scale "Porcupine" project has been successfully completed (March 1977). This project included, in particular, a Soviet experiment involving injection of a stream of xenon plasma, and a West German experiment involving injection of a stream of barium. It also included optical observations conducted with the aid of ultrasensitive Soviet equipment carried on board a YaK-40 airborne observatory. There was also an exchange of scientists within the framework of cooperation on the problem "Radio Astronomy." Within the framework of the agreement with NNIO the USSR Academy of Sciences sent 32 scientists to the FRG and received 27 West German scientists.

Ties between the USSR Academy of Sciences and Italian scientific establishments experienced further development. At the Third Session of the Mixed Commission on Scientific and Technical Cooperation Between the USSR and Italy (Moscow, May 1977), a "Long-Range Program of Development of Scientific and Technical Cooperation Covering a 10-Year Period" was signed, specifying the conduct of joint research on 16 problems involving the AS USSR in the area of the physicochemical, mathematical, chemical engineering and biological sciences.

In implementation of this program, 17 scientists from the AS USSR visited Italy in 1977. A total of 45 academy scientists and specialists traveled to Italy within the framework of the agreement between AS USSR and the National Center for Scientific Research. The AS USSR in turn received 30 Italian scientists.

The Seventh Conference of Soviet and Italian historians was held in Moscow in May, and a bilateral Pushkin Colloquium for Literary Scholars was held in Rome in June.

At the invitation of the Academy of Sciences, a delegation of Italian scientists led by Professor E. Quagliariello, president of Italy's National Research Council, visited the USSR from 11 to 23 November. The delegation visited scientific establishments in Moscow, Pushchino, and Novosibirsk.

Cooperation with Austrian scientific establishments was carried out on the basis of an agreement between the AS USSR and the Austrian Academy of Sciences. Fifteen scientists of the AS USSR visited Austria in 1977, while Austrian scientists visited Soviet academy scientific establishments.

Within the framework of cooperation with the Science and Research Division of the Swiss Department of Internal Affairs, the USSR Academy of Sciences sent nine scientists to Switzerland, and three Swiss scientists visited the USSR.

Successful scientific cooperation between scientists of the AS USSR and Finnish scientists took place in an atmosphere of constantly growing friendship and mutual trust between the peoples of the two countries, and extensive economic, scientific and cultural ties between the USSR and Finland.

Further development of Soviet-Finnish scientific ties, successful activities of working groups in the area of cybernetics, physics, zoology and experimental biology, geology, geophysics, economics, archeology, history, ethnography and anthropology, psychology and sociology, literature, folklore, and linguistics were noted at the 23d Session of the Soviet-Finnish Commission on Scientific and Technical Cooperation, held in Moscow in May 1977.

Within the framework of the long-range program, symposia on economics, Finno-Ugric studies and linguistics, a biological symposium entitled "Control of Cell and Tissue Differentiation" were held in Finland in 1977. Symposia on physics and evolution of stars, cybernetics, and history were held in the USSR.

Within the framework of the long-term program and the protocol on cooperation with the Finnish Academy, 41 Soviet scientists were sent to Finland and 71 Finnish scientists were sent to the USSR.

Cooperation with Swedish scientific establishments was carried out on the basis of an agreement between the AS USSR, the Royal Swedish Academy of Sciences and the Royal Swedish Academy of Engineering Sciences, as well as on the basis of an intergovernmental cultural and scientific exchange program. Within the framework of the Agreement and Program, 19 Soviet scientists were sent to Sweden, and 40 Swedish scientists were sent to the Soviet Union. Fruitful scientific contacts continued in the area of astrophysics and plasma physics.

Scientific ties with Norwegian scientists area were effected on the basis of an intergovernmental cultural and scientific cooperation program.

Cooperation began in the preceding year between scientists of the AS USSR Institute of Earth Physics imeni O. Yu. Shmidt and the Norwegian Polar Institute, in the area of geomagnetic observations. Soviet research equipment was placed on Norwegian islands in the North Sea. Scientific research by the AS USSR continued on the Spitsbergen Archipelago, where a glaciological, a geological and an astronomical expedition were working.

Cooperation between Soviet and Danish scientists is governed by an agreement between the AS USSR and the Niels Bohr Institute of Theoretical Physics and a program of cultural and scientific cooperation between the USSR and Denmark.

Nine scientists from the AS USSR visited Denmark, while eight Danish scientists were received at Soviet academy scientific establishments.

A long-term program of Soviet-Danish scientific cooperation on basic research in the natural and applied sciences was signed at the Eighth Session of the Intergovernmental Soviet-Danish Commission on Economic and Scientific-Technical Cooperation (Moscow, June 1977).

Contacts with Belgian scientific establishments were based on an intergovernmental agreement on cultural and scientific cooperation and the Protocol of the Fifth Session of the Mixed Commission on Economic and Scientific-Technical Cooperation, on the basis of which eight scientists from the USSR Academy of Sciences visited Belgium and five Belgian scientists were received by the Academy.

Two scientists from the AS USSR visited the Netherlands on the basis of a cultural and scientific cooperation agreement, while three Dutch scientists visited the USSR. There was continued cooperation between the AS USSR Institute of Chemical Physics and the Dutch company (AKZO) on study of the chemical properties of 2.6-diaryl phenols and the general patterns of destruction and stabilization of polymers; the third symposium on these problems was held in Moscow in November.

A combined geological-geophysical expedition of the AS USSR, a party of 17, continued work in Iceland from July through October 1977. This expedition has worked in Iceland each year, beginning in 1971. In 1977 the AS USSR received three visiting Icelandic scientists.

Scientific ties with Canadian scientists were effected on the basis of an agreement between the AS USSR and the Canadian National Research Council (in the area of the natural sciences) and an intergovernmental program of cultural and scientific cooperation (in the area of the social sciences). Within the framework of both agreements, the AS USSR sent 24 scientists to Canada and received 21 Canadian scientists in the USSR.
In June 1977 a delegation from the AS USSR left for Canada for talks on development of further cooperation with Canada's National Research Council. The AS USSR submitted proposals on development of joint research on a number of scientific problems which are currently being studied in Canada.

Cooperation with Australian scientists underwent further development in 1977. The contractual-legal basis for this cooperation is an agreement on scientific and technical cooperation between the USSR and Australia dated 15 January 1975, and programs of cooperation in the area of radio astronomy, entomology and the earth sciences, an intergovernmental program of cultural exchanges specifying exchange of specialists in the social sciences, as well as an agreement for exchange of scientists from the Institute of Eastern Studies and the Institute of World Economics and International Relations of the AS USSR and the Australian National University (ANU), elaborated on the basis of the Agreement.

In 1977 scientists from the AS USSR Institute of State and Law and the AS USSR Institute of World Economics and International Relations (IMEMO) left for the Australian National University. On the invitation of IMEMO, Dr R. O'Neill, director of the ANU Center for Strategic Studies, visited the USSR.

Within the framework of the intergovernmental program of cultural cooperation, Australia was visited by the deputy director of the AS USSR Institute of Eastern Studies, K. V. Malakhovskiy, while Dr S. (Dreyer), an ANU scholar, visited the Soviet Union.

Cooperation with Japanese scientific establishments took place on the basis of an agreement on exchange of scientists between scientific establishments of the AS USSR and Japanese Government establishments and universities, a program of cultural and scientific exchanges between Soviet and Japanese organizations through the Union of Soviet Friendship Societies (SSOD) and the Japanese Association for Cultural Ties With Foreign Countries (YaAKS), as well as protocols on cooperation between the AS USSR Institute of Eastern Studies, (Ritsumeykan) University, and (Khosey), International Relations House (Japan).

Three symposia were held in Japan within the framework of cooperation with YaAKS: the Third Symposium on Problems of Collective Security was held in Tokyo in October, and the Third Symposium of Historians and Fourth Symposium on Electronics in December. Other events included: in Japan -- the

Fourth Seminar on Catalysis, the Sixth Symposium on the Physicochemical Principles of Metallurgical Processes; in Moscow -- the First Seminar on Corrosion of Metals, a symposium entitled "Peace and Security in Asia," and in Pushchino -- the First Seminar on Fermentation.

In 1977 138 Soviet scientists visited Japan, and 123 Japanese scientists visted the Soviet Union.

Scientific ties with Indian scientists continued to develop as before on the basis of the Program of Scientific Cooperation Between the AS USSR and the Indian National Academy of Sciences (INAS), an Intergovernmental Program of Cultural and Scientific Exchanges Between the USSR and India, an Agreement on Cooperation in the Area of the Applied Sciences and Technology (involving the USSR State Committee for Science and Technology), and an Agreement Between the AS USSR and the Indian Statistical Institute on publication in India of translations of the works of Soviet scientists.

Within the framework of cooperation with INAS, the Second Soviet-Indian Symposium on Plant Embryology was held in Leningrad in August 1977. Joint research continued on topics contained in the Long-Term Cooperation Program: low-temperature physics, deep seismic probing, plasma physics, plant genetics and selection, mathematical statistics, and chemistry of natural compounds. First steps were taken toward establishing cooperation in geothermal studies, crystal growth, and neutrino astronomy.

Seventeen Soviet scientists were sent to India in 1977 in connection with the interacademy cooperation program, and 13 scientists were sent on the program of cultural and scientific exchanges.

The AS USSR Institute of High Temperatures, in conformity with the agreement on cooperation in the area of applied sciences, continued assisting India in designing and building in India an MHD installation. In connection with this 11 Soviet specialists were sent to India and 12 Indian specialists visited the USSR.

Soviet-Indian ties in the area of the social sciences continued to develop. The holding of a number of bilateral symposia and other events in 1977-1978 was specified at a meeting in New Delhi in April of the Soviet-Indian Commission on Cooperation in the Social Sciences.

Three symposia were held in 1977: "Modernization of Traditional Institutions" (New Delhi), "Study of the Ancient Civilizations of Central Asia" (Dushanbe), and a symposium on problems of international law (Moscow).

The Indian Statistical Institute Press published in 1977 the following books by Soviet authors: a monograph by Academician B. M. Kedrov entitled "Materiya i yeye dvizheniye" [Matter and Its Motion], a book by A. D. Litman entitled "Filisofskaya mysl' nezavisimoy Indii" [The Philosophical Thought of Independent India], and a collected volume entitled "Istoriya Indii" [History of India].

In Afghanistan a Soviet-Afghan archeological expedition, including nine Soviet scientists, continued operations in 1977.

A delegation of Soviet scientists traveled to Afghanistan to attend an international seminar honoring the 80th anniversary of the death of the famous philosopher Jemal-ad-dina al-Afghani (Kabul, March 1977). Representatives of the USSR Academy of Sciences took part in an international seminar on the topic "Pushtu Printed Works in the Last Two Centuries" (Kabul, August 1977) and a seminar honoring the memory of the poet Hakim Sanai Gaznevi. Four Afghan scientists visited the Soviet Union in 1977.

Scientific ties between scientists of the AS USSR and Iraqi scientists were effected on the basis of a 1972 protocol on cooperation with Iraq's Scientific Research Organization. Last year the text of a new protocol between the AS USSR and this organization was agreed upon and was signed at the beginning of January 1978.

V. G. Berezkin, laboratory chief at the USSR Academy of Sciences Institute of Petrochemical Synthesis, traveled to Iraq within the program of cooperation with the Scientific Research Organization; he delivered a series of lectures on the fundamentals of gas chromatography to Iraqi specialists. An archeological expedition of the AS USSR continued operations in Iraq in 1977.

Scientific exchanges with Turkey are based on a cultural and scientific cooperation program for 1976-1978.

The AS USSR sent to Turkey a scholar from the AS USSR Institute of Eastern Studies, B. M. Potskhveri, to study problems of Turkish foreign policy, as well as the director of the Scientific Information Center for the Social Sciences of the Academy of Sciences of the Azerbaydzhan SSR, A. A. Zargarov. At the invitaion of the school of forestry at Istambul University, E. A. Kurbanov, laboratory chief at the Botany Institute of the Academy of Sciences of the Azerbaydzhan SSR, visited Turkey to present lectures on cytoembryology. Doctor (Pars Tukladzhi), chairman of the editorial and publishing council of the Great Turkish Encyclopedia, was a guest of the Institute of Eastern Studies and the Institute of Scientific Information on the Social Sciences of the AS USSR. Four scientists from the AS USSR took part in international events held in Turkey.

R. M. Munchayev and N. Ya. Merpert, scientists from the AS USSR Institute of Archeology, visited Jordan.

Scientific ties with the countries of the Near East weakened somewhat in 1977, which is connected chiefly with deterioration of the political situation in that region as a consequence of continuing Israeli aggression.

As a result of the unfriendly policy of the Egyptian Government, scientific cooperation with the scientists of this country has practically come to a standstill. Scientific contacts in 1977 were effected only through Astrosovet, which is conducting photographic observations of satellites from a station located in Egypt. Three specialists went to Egypt to conduct observations. A total of 31 scientists from the AS USSR visited countries in the Near East in 1977.

The volume of scientific contacts with the African countries was small in 1977. A Soviet delegation to the UN International Conference in Support of the Peoples of Namibia and Zimbabwe, held in Mozambique, included L. V. Goncharov, deputy director of the AS USSR Africa Institute. He also attended the World Conference of Actions Against Apartheid, which was held in Lagos (Nigeria).

Soviet scientists attended the Second Congress of the African Political Science Association in Morocco.

A satellite photographic observation station continued operating in the Republic of Chad. Equatorial Africa's first planetarium was opened under the auspices of this station on 14 October 1977, with Astrosovet personnel delivering more than 20 lectures for the local populace.

At the present time the USSR has cultural and scientific cooperation agreements with eight Latin American countries, on the basis of which programs of cultural and scientific exchanges are being elaborated.

In 1977 a working program of exchanges (in the area of the social sciences) was signed only with Mexico. Alongside this program there was also in operation a program of scientific and technical cooperation. Under the auspices of this latter program, two specialists from the AS USSR All-Union Institute of Scientific and Technical Information visited Mexico for the purpose of becoming acquainted with organization of scientific and technical information in that country and determining areas of cooperation in the information field, while two scientists from the Institute of Evolutionary Morphology and Animal Ecology imeni A. N. Severtsov of the AS USSR traveled to Mexico to present lectures and draft proposals on cooperation in the area of marine biological resources, and a scientific worker from the Institute of Problems of Control (Automation and Remote Control) visited Mexico to present lectures on theory of optimal control methods.

Astronomical stations for performing photographic satellite observations continued operations in Bolivia and Ecuador.

Scientists from the AS USSR attended international scientific conferences: in Brazil -- the 18th International Conference on Coordination Chemistry; in Colombia -- the First International Congress of Latin American Geographers; Peru -- the 11th Peruvian Chemical Congress.

This past year was characterized by continuing stepped-up activities of the USSR Academy of Sciences in international scientific organizations.

The AS USSR joined three new organizations: the Federation of European Microbiological Societies, the International Organization for Crystal Growth, and the Scientific Committee of the International Council of Scientific Unions (MSNS) on Genetic Experimentation. As of 1 January 1978 the total number of organizations of which the AS USSR is a member was 162. Nine Soviet scientists have been elected president of international scientific organizations, 47 have been elected vice-president, and 112 have been elected member of executive bodies.

In 1977 scientists of the AS USSR participated actively in carrying out such international programs, projects and research as "Exploration of Space," "World Ocean," the International Geological Correlation Program (MGK), "Man and the Biosphere," the United Nations Environment Program (UNEP), the Global Atmospheric Processes Research Program (PIGAP), the global "International Magnetospheric Studies" project, the International Geodynamic Project (MGP), and others.

Currently 62 projects proposed by scientists from various countries are being elaborated within the framework of the International Geological Correlation Program. An international working group has been established for each project. Soviet scientists were placed in charge of five projects and are members of the working groups on 15 projects.

Soviet scientists are continuing to participate in projects on the topic "International Studies of the Magnetosphere" and in the International Geodynamic Project.

In 1977 research continued on the international project entitled "The Great Chord." Twenty-six earth satellite observation stations located in the countries of Asia, Africa and Latin America are presently working in this program.

Scientists of the AS USSR are making their contribution toward the UNESCO program "Man and the Biosphere." Academician V. Ye. Sokolov, chairman of the Soviet national committee on participation in this program, was in 1977 reelected vice-president of the "Man and the Biosphere" (MAB) International Coordination Committee.

Specialists from the AS USSR are actively participating in the UN program on environmental problems (UNEP). On the instructions of the UNEP Secretariat, they began drafting an international program of study, utilization and conservation of the planet's natural resources.

Processing of the materials of the International Biological Program (MBP) is continuing. Information on the various parts of the program is being sent to the Soviet Union from various countries.

Within the framework of the European (Vienna) Center for Coordination of Research and Documentation in the Social Sciences, scholars from humanities institutes of the AS USSR completed work in 1977 on two major programs: "Automation and Industrial Workers," and "Criteria of Selection Between Market and Extramarket (Public) Ways to Meet the Needs of the Population." Soviet scientists are working on two new programs: "Cultural Development Trends in the Contemporary Society. Interaction of National Cultures" (AS USSR Institute of Ethnography), and "Cooperation Among European Social Sciences Information and Documentation Centers" (AS USSR Institute of Scientific Information in the Social Sciences).

A conference of UNESCO consultants was held in Paris in 1977, on the topic "Quality of Life Indicators and the Environment" (within the framework of implementation of the long-term UNESCO program to study the problems of quality of life indicators).

In 1977 scientists and specialists of the AS USSR participated in more than 30 scientific measures conducted by intergovernmental organizations, including conferences of UN and UNESCO consultants, visits by experts to developing countries, scientific trips on UNESCO stipends, etc. Representatives of the AS USSR also took part in all major UN and UNESCO conferences and in many measures conducted by WHO (World Health Organization), WMO (World Meteorological Organization), IAGATE (International Atomic Energy Agency), UNIDO (UN Industrial Development Organization), plus other organizations.

Holding in this country of the first conference of European social sciences information and documentation centers (Moscow, June 1977) was a major positive event in the development of international cooperation in the area of the social sciences. This event was organized by the Vienna Center for Coordination of Social Sciences Research and Documentation on the instructions of UNESCO, in execution of the provisions of the Final Act of the Conference on Security and Cooperation in Europe. The results of the conference received considerable international response, and its success was ensured by protracted organizational and scientific preparation, performed for the most part by the Soviet Union in close cooperation with the other socialist countries.

The 22d (Paguosh) Conference of Scientists (FRG, August 1977) was a central event of 1977 in the Paguosh Movement. In all working groups and at the plenary sessions of the conference considerable attention was focused, at the initiative of Soviet scientists, on discussion of questions connected with U.S. intentions to produce the neutron bomb. The summary documents at the conference rang out with stern condemnation of this new mass destruction weapon and contained appeals to the U.S. Government to refrain from producing the neutron bomb.

In 1977 lunar soil samples taken by the Luna-24 automatic station was transmitted to scientific organizations in the United States, Great Britain, France, and India. Sharing of lunar soil with other countries not only promotes consolidation of the efforts of scientists of different countries in studying the matter making up the universe but is also of great importance for strengthening the prestige of Soviet science abroad.

One channel for acquainting people in other countries with the achievements of Soviet science, just as in preceding years, was voyages by the USSR Academy of Sciences research vessels "Vityaz'," "Akademik Kurchatov," "Dmitriy Mendeleyev," "Mikhail Lomonosov," "Akademik Vernadskiy," and "Professor Bogorov." When our vessels would put into ports in capitalist and developing countries, contacts would be established with the scientists of these countries. Foreign scientists and foreign civic leaders inspected the research vessels, their equipment, scientific laboratories, organization of research and became acquainted with the life of the expedition scientists.

Scientists of the USSR Academy of Sciences take active part in acquainting their foreign colleagues and the public abroad with the socioeconomic achievements of the peoples of our country as well as achievements in the area of science and culture.

Particularly indicative in this regard was this past year, 1977 -- year of the 60th anniversary of the Great October Socialist Revolution and year of adoption of the new USSR Constitution.

Activities dedicated to these events were held in many countries throughout the world, including the United States, France, the FRG, Italy, Canada, Japan, Australia, India, and other countries.

In France, for example, in October 1977, in connection with the 60th anniversary of the Great October Revolution, Soviet Science and Technology Days were held, which involved the participation of many Soviet scientists, including Academicians V. A. Kotel'nikov, M. A. Markov, A. A. Dorodnitsyn, P. G. Kostyuk, R. Z. Sagdeyev, A. B. Severnyy, N. M. Emanuel', Corresponding Member AS USSR V. V. Migulin, and others. Lectures by A. A. Dorodnitsyn entitled "Mathematics and Problems of the Environment," by R. Z. Sagdeyev entitled "Space Exploration Today and Tomorrow" and other lectures by Soviet scientists demonstrated the vast superiority of socialism in utilization of the achievements of scientific and technological progress for the good of mankind and the great successes of Soviet science.

Within the confines of a journal article it is impossible to enumerate all the jubilee events which took place abroad in 1977. Nor can we list the names of all the Soviet scientists who took part in these events. We shall cite only a few examples attesting to the broad scale of celebration of this great date.

Academician N. P. Fedorenko delivered lectures: at Tokyo University -- "Achievements of Soviet Economic Science in the 60 Years of Soviet Rule," and at Kyoto University -- "Employment of Economic-Mathematical Methods in Planning and Management of the Economy of the USSR." Corresponding Member AS USSR Yu. A. Polyakov attended a scientific conference in West Berlin dedicated to the 60th anniversary of the Great October Revolution.

In June-July 1977 B. S. Orlov, a scientist at the AS USSR Institute of Scientific Information on the Social Sciences, delivered a series of lectures in the FRG on USSR foreign policy at the invitation of the University of Bonn. G. A. Trukan, a scholar at the AS USSR Institute of History of the USSR, presented a paper entitled "The Great October Revolution and the Events in Russia in 1917" at a Soviet-Finnish symposium in Tampere (Finland). In September 1977 G. N. Sevost'yanov, a scholar at the AS USSR Institute of General History, attended scientific symposia held in Australia and New Zealand in connection with the 60th anniversary of the October Revolution. He presented a series of lectures on the achievements of our people during the years of Soviet rule and on USSR foreign policy.

Scientists from the AS USSR Institute of World Economics and International Relations took active part in jubilee events held in the United States, France, Australia, Iraq, and other countries. Their lectures stressed the enormous significance of the resolutions of the 25th CPSU Congress for development of the nation's economy and expansion of external political relations of the USSR.

Scholars from the AS USSR Institute of Eastern Studies presented lectures in 1977 in Austria, Switzerland, Japan, India, Sudan, Tunisia, Morocco and other countries on the Soviet way of life, socialist democracy, the achievements of our people in the social, economic, scientific-technical and cultural areas, and on the foreign policy of the Soviet Union.

Scholars from the AS USSR Institute of Ethnography participated extensively in jubilee events abroad. Institute director Academician Yu. V. Bromley presented a paper entitled "Soviet Ethnography and Social Anthropology" at a Soviet-American symposium (United States, October 1977). Institute scholars T. A. Zhdanko and M. K. Kudryavtsev presented papers on the historical experience of the Soviet Union in building a new society at a Soviet-Indian symposium entitled "Traditional Institutions in the Process of Modernization of Society: the Experience of India and the Soviet Central Asian Republics."

V. S. Semenov, a scholar at the AS USSR Institute of Philosophy, presented a series of lectures in Sweden on the development of Marxist-Leninist philosophical science during the 60 years of Soviet rule.

Scholars from the AS USSR Institute of the International Worker Movement presented lectures in the United States, Canada, Italy, Portugal, and Ireland, dedicated to the 60th anniversary of the Great October Revolution.

Scholars from the AS USSR Institute of Sociological Research traveled to the United States: G. V. Osipov -- to present a three-week series of lectures on theory and history of Soviet sociology, and I. V. Bestuzhev-Lada -- to present lectures on the Soviet way of life, contemporary problems of social forecasting, scientific-technical revolution and its social consequences.

Scientists from the AS USSR Central Economics-Mathematics Institute presented lectures abroad on the economic achievements of the USSR and the development of Soviet economic science.

Scholars from the AS USSR Africa Institute presented lectures on the proceedings of the 25th CPSU Congress and the 60th anniversary of the October Revolution, in Syria, Jordan, Zambia, Tanzania, Ethiopia, and other countries in Africa and the Near East.

In connection with the 60th anniversary of the Great October Revolution, exhibits were held in many capitalist and developing countries, exhibits telling of our country's achievements during the years of Soviet rule. The USSR Academy of Sciences organized a number of exhibits and also took part in USSR national exhibits abroad.

Sixteen exhibits on the achievements of Soviet scientists in various fields of science were held in the United States, Canada, France, the FRG, Japan, Turkey, Venezuela and other countries.

A large, interesting USSR Academy of Sciences exhibit was displayed at the USSR National Exhibit which opened in November 1977 in Los Angeles (United States). The exhibit told of space exploration conducted by our country in recent years and utilization of its results in the nation's economy.

An exhibit entitled "Space Serving Peace and Progress" was held from March through September 1977 in Vancouver and Ottawa (Canada). The exhibit was visited by 400,000 Canadians and residents of U.S. northern states.

An exhibit entitled "Achievements of Science and Technology in the USSR" was held in France in October-November 1977, during Soviet Science and Technology Days; this exhibit contained, in particular, displays presented by the AS USSR.

A large and interesting AS USSR exhibit relating the major achievements in various fields of science was displayed at the "60th Anniversary of the Soviet State" exhibit organized by the USSR Chamber of Trade and Industry in Tokyo and Osaka (Japan) and in Caracas (Venezuela).

AS USSR exhibits graphically demonstrated the superiority of the developed socialist society, attested to the high level of development of Soviet science, and showed the ever increasing influence of science on development of the economy of the Soviet Union. They promoted further strengthening of friendship and cooperation between peoples and nations and made a contribution to the cause of the struggle for peace throughout the world.

Scientists from the USSR Academy of Sciences took active part in publicizing the new USSR Constitution. Scholars from many institutes presented lectures on this historic document.

Approximately 100 lectures on the Fundamental Law of the USSR were presented abroad by scholars from the AS USSR Institute of State and Law. M. A. Krutogolov presented lectures in France, Greece, and the Netherlands; V. A. Tumanov -- in France, the FRG, and Austria; M. M. Boguslavskiy, in Switzerland. The USSR Constitution was the subject of a TV appearance in the United States by S. L. Zivs. Yu. A. Tikhomirov, the institute's deputy director, S. L. Zivs, B. N. Topornin and V. M. Savitskiy spoke at a press conference set up by the USSR Ministry of Foreign Affairs for foreign journalists and dealing with the main problems of the draft USSR Constitution. Articles by Corresponding Member AS USSR V. N. Kudryavtsev, director of the Institute of State and Law, and M. A. Krutogolov on our country's new Fundamental Law were also published abroad.

Soviet scholars attending the World Congress of the International Association of Legal and Social Philosophy (Australia, August 1977) -- Corresponding Member AS USSR D. A. Kerimov, B. N. Topornin, and V. V. Laptev -- presented a proposal calling for holding a scientific seminar within the framework of the congress, dealing with the draft new USSR Constitution. The scholars' proposal was adopted. D. A. Kerimov presented a paper on the draft new USSR Constitution. B. N. Topornin and V. V. Laptev also spoke on the draft Fundamental Law of the USSR. The seminar was attended by approximately 200 foreign scholars. In the course of the seminar the Soviet scholars were asked more than 70 questions, most of which dealt with guarantees of the rights and freedoms of Soviet citizens, functioning of the political system, forms of ownership and control of socioeconomic processes, the status of the union and autonomous republics within the USSR, and possibilities of monitoring and criticizing the actions of officials.

The seminar helped refute slanderous anto-Soviet interpretations of the draft USSR Constitution and promoted a more correct understanding of genuine socialism in practice.

A great many scientists of the AS USSR were awarded international and national honors in 1977 for their contribution to the development of world science. Many were elected honorary members of foreign scientific organizations and societies, were awarded honorary doctorates by universities, and appointed to the editorial boards of foreign scientific publications. This is one more evidence of the steady growth in the prestige of Soviet science.

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SCIENTISTS AND SCIENTIFIC ORGANIZATIONS

OBITUARY OF VSEVOLOD VLADIMIROVICH FEDYNSKIY

Moscow IZVESTIYA AKADEMII NAUK SSSR, FIZIKA ZEMLI in Russian No 11, 1978 pp 108-110

[Article by a group of comrades]

[Text] Communist Vsevolod Vladimirovich Fedynskiy, a prominent soviet geophysicist, corresponding member of the USSR Academy of Sciences, doctor of physical and mathematical sciences, professor, director of the geophysics department and department of geophysical methods of study of the earth's crust of the Geological Faculty of Moscow State University, died suddenly on 17 June 1978. In him, soviet science lost a most important scientific organizer, scientific innovator and a wonderful teacher.

With his name we associate many and diverse investigations into the different areas of geophysics, and primarily gravimetry. We most particularly note his renowned, almost 50-year journey in exploratory geophysics. It was precisely in this field that his brilliant gift was developed. Having begun his own work at the beginnings of petroleum geophysics, he promoted its widespread and explosive developments in production as well as its being a subdivision of scientific research. He was active for many years in the petroleum industry and, for two decades in the USSR Ministry of Geology, in the vanguard of progressive ideas, he energetically promoted the achievement of scientific technological progress in exploratory geophysics.

His great talent for scientific organization, tremendous energy, widespread knowledge, exceptional capacity for foresight and the ability to unite and lead large groups in resolving giant tasks of great importance primarily for the national economy was always evident during this feverish activity.

He made use of his great authority abroad. He actively participated in a series of congresses and international arrangements. For many years he actively participated in the efforts of the Committee of the International and Geodesical Union to study the earth's crust and upper mantle.

He was full of energy, creative daring, plans for large-scale studies in the institute of the USSR Academy of Science. A sudden death cut off his feverish activity, but the rich inheritance he left will be highly valued.

He was born 1 May 1908 in the Verkhnyaya Bogachka settlement of Poltavskaya Oblast to the family of a Zemstvo section doctor.

Upon graduating from secondary school he entered the physics and mathematics department at Moscow State University in 1925, finishing in 1930 with specialties in astronomy and gravimetry. While still a student he began to work in the gravimetric group, and upon graduation from the university he worked in exploratory geophysics, which became the principal occupation of his life. From 1929 to 1936 he directed separate gravimetry groups in Azerbaijan, Dagestan, Turkmeniya, on the Caspian Sea and in Povolzh'ye. From 1936 to 1941 he directed the gravimetric work in the petroleum industry. During the war he became chief engineer of the affiliated branches of (GSGT) in Azerbaijan and Turkmeniye, and in 1944 he created the Central Scientific-Research laboratory of applied geophysics in Moscow, later changed to the "All-Union Scientific Research Institute of Geophysics." In 1952 he became chief engineer, and then head of the Geophysical Central Directorate of the Ministry of the Petroleum Industry. Later on he worked for a while by directing one of the branches of the Institute of Earth Physics of the USSR Academy of Sciences, and then came to the USSR Ministry of Geology as chief of the Administration of Geophysical Work, as a member of the Collegium of the Ministry. Here he worked for 20 years (to the middle of 1977). At the same time he carried out considerable teaching duties at Moscow University, where he headed the department of geophysics of the geological faculty.

Naturally, it is impossible to dwell in more detail on his work in this organization. We merely note a few directions of his work.

Conducting large-scale work in industry, as an important scientist he had close ties with scientists of the Academy of Sciences of the USSR and Union Republics, and also the country's leading institutions of higher education.

As a young man he fruitfully worked under the direction of Academician A. D. Arkhangel'skiy on the creation of the fundamentals of geological interpretation of regional gravitational and magnetic anomalies. These classical studies are widely known because, to a significant degree, they are the bases of the new scientific specialization, regional tectonics. Association with important academic geologists furthered his explanation of the organic connections of geology and geophysics to them and this, in particular, was clearly shown in the creation and growth of regional systems of geophysical research in various geological conditions.

His creation of the first soviet gravimeters and development of the methods of gravimetric observations while in motion were very significant contributions. He was awarded the Government Prize, in the presence of other executives, for his work on domestic gravimeters.

All of his activities were characterized by a constant attention to the worldwide development of the tools of geophysical research. He gave exceptional significance to carrying out on a large scale, under his direction, the scientific and technical reequipment of the country's geophysical exploration service; in particular, the conversion to numerical techniques, significantly raised the quality of geophysical studies and their geological efficiency.

He gave considerable importance to his research in marine geophysics, which he first became interested in as far back as the beginning of his scientific and industrial activities. Now marine geophysical studies, which were changed with his direct participation into a powerful complex of methods well provided with equipment and facilities, are being conducted in great numbers in all the seas and on the shelves of our country and in the oceans. Through his initiative and under his immediate direction the department of Geophysics of the Geological faculty of Moscow State University has already been preparing specialists in marine physics for many years.

The wide range of interests, characteristic of modern major scientists, of the researcher in the earth sciences explains the great attention paid to the study of the structure of the earth's crust and upper mantle by Vsevolod Vladimirovich. In these studies he and the collective directing them maintained close ties with scientists of the USSR Academy of Sciences and Union Republics. Similar contacts to them were developed through the applications of computers to the processing and interpretation of geophysical data, the use of holographic methods, the growth of space geology and the study of the structure of the shelves, sea floor and oceans.

And finally, one must separately mention his many years of work in the study of meteorites and meteoric matter. During recent years he was assistant to the chairman of the committee on meteorites under the USSR Academy of Sciences.

He was the author of more than 150 published works on the various problems of geophysical and astronomical studies. His monograph "Exploratory Geophysics" which culled the theoretical and methodic knowhow and basic results of geophysical studies, has already been republished several times. The collected works, shown at international geological congresses, offer great value.

Together with his great scientific, industrial and pedagogical activities he focused much energy and attention on public work. He was a member of the (Military and Administration Committee), a member of a series of scientific councils of Moscow institutes, a member of the editorial staff of a number of journals, chairman of the geophysical section of the scientific and technical council of the USSR Ministry of Geology, a member of the Presidium of the Scientific and Technical Society of Mining, a methodical leader of theoretical seminars on different scientific, philosophic and economic questions and leader of the propaganda lecture work.

For great services in geophysical science and production he was awarded four order of the (Labor Red Banner), the order of the (Mark of Honor) and a number of medals.

His considerable culture, wide range of scientific interests and knowledge, versatile, significant and fruitful work, responsiveness and benevolence gained him the deep respect of his comrades, scientists and all who came into contact with him during his many-sided activities.

The fond memory of the prominent soviet geophysicist Vsevolod Vladimirovich Fedynskiy will remain in our hearts for a long time.

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CSO: 1870

PUBLICATIONS

UDC 621.396.664 (024)

MEASUREMENT AND CONTROL OF THE PARAMETERS OF TECHNICAL COMPLEXES

Moscow IZMERENIYE I KONTROL' PARAMETROV TEKHNICHESKIKH KOMPLEKSOV (Voprosy metrologii) [Measurement and Control of Parameters of Technical Complexes (Problems of Metrology)] in Russian 1978 signed to press 26 Apr 78 p 2, 127-128

[Annotation and table of contents from book by V. P. Yekhlakov and L. V. Makov, Voyenizdat, 6200 copies, 128 pages]

[Text] This book examines in an accessible form the main theoretical propositions of metrology. Factors affecting the accuracy of measurements are evaluated on their basis, ways of reducing errors are shown, recommendations are given for improving the accuracy and certainty of measurements, basic principles of checking measuring instruments are given, the organization of the metrological service in our country is explained, and brief information is given on the metrological institutions of the USSR and international metrological organizations.

This book is intended for engineers and technicians operating technical complexes of various purposes and can be used as a textbook for training inspectors of the checking agencies.

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CSO: 1870

PUBLICATIONS

UDC 621.385.6

CROSSED-FIELD MICROWAVE AMPLIFIERS

Moscow SVERKHVYSOKOCHASTOTNYYE USILITELI SO SKRESHCHENNYMI POLYAMI (Crossed-Field Microwave Amplifiers) in Russian 1978 signed to press 2? Dec 77 p 2-3, 278-280

[Annotation, foreword, and table of contents from book by M. B. Tseytlin, M. A. Fursayev, and O. V. Betskiy, Sovetskoye radio, 5500 copies, 280 pages]

[Text] The authors explained the methods of the calculation and analysis of crossed-field microwave amplifiers (M-type). They examine beam-type amplifiers (with the electron-optical system beyond the interaction distance) and amplitrons -- amplifiers with the cathode within the interaction distance. In addition to the general theory of the interaction of an electron flow with a slow electromagnetic wave in the large-signal mode, much attention is given to the investigation of new circuits and various operation modes of beam-type devices. The section on the amplitron gives an analysis of the principal electrical characteristics, as well as calculations of the output parameters of the amplifier.

This book is intended for engineers and scientists working in the area of microwave electonics and radio physics, as well as for teachers and students of vuzes. It can be used as a teaching aid for design projects in courses and in preparation for degrees.

Figures -- 157, tables -- 8, bibliography -- 175 items.

Foreword

This book treats the methods of calculation and analysis of the most widespread and promising magnetron-type microwave amplifiers -- amplitrons and beam-type amplifiers.

At the present time, many types of amplitrons operating in the pulsed and continuous modes and covering the decimetric, centimetric, and even millimetric wavelength bands have been developed. However, there still is no generalized material on the theory and analysis of the amplitron operation. These problems are discussed only in numerous articles in journals.

In recent years, much attention has been given in the Soviet Union and abroad to M-type beam devices (with the electron-optical system beyond the interaction distance). There have appeared a number of articles investigating the new tendencies in the design of beam-type amplifiers and discussing the possibilities of improving the main characteristics of this class of microwave devices.

Since there are no monographs on crossed-field microwave ampliers, it is of scientific and practical interest to generalize the vast material on the theory of the M-type beam devices, as well as on the analysis and computation methods of the amplitron in one book. The book consists of two parts.

Part 1 (Chapters 1-5) treats the theory of beam-type amplifiers. Chapter 1 gives a survey of the main types of microwave amplifiers. In Chapters 2 and 3, nonlinear theory equations are derived and the operation of amplifiers in the mode of large amplitudes is analyzed. Chapter 4 analyzes new circuits of beam-type devices with higher amplification factors. Chapter 5 discusses the interaction of the electron beam with higher time harmonics of the microwave field.

Part 2 (Chapters 6-9) analyzes the operation of amplifiers with the cathode within the interaction distances (amplitrons). Chapter 6 discusses the physical principles and special characteristics of the operation of amplifiers with the cathode within the interaction distance, and Chapter 7 gives the methods for analyzing amplitron operation. The analysis of electrical characteristics of the amplitron is treated in Chapter 8. Chapter 9 discusses the operation of the amplitron with consideration for the excitation of parasitic types of oscillations.

The material of the book is based, chiefly, on works published in journals in recent years.

The introduction and Chapter 1 were written by O. V. Betskiy; Chapters 2 and 3 -- by M. B. Tseytlin; Chapters 4 and 5 -- by M.B. Tseytlin and O. V. Betskiy; Chapters 6-9 -- by M. A. Fursayev; the conclusion was written by the authors jointly.

The authors express their gratitude to I. V. Lebedev for discussing a number of sections in the book and his valuable observations, to the reviewer, Z. S. Chernov, for his useful criticisms, as well as to I. T. Tsitsonya for performing certain numerical computations on an electronic computer.

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PUBLICATIONS

UDC 681.34:621.3.049.77

INTEGRATED CIRCUITS OF ANALOG-DIGITAL AND DIGITAL-ANALOG CONVERTERS

Moscow INTEGRAL'NYYE SKHEMY ANALOGO-TSIFROVYKH I TSIFRO-ANALOGOVYKH PREOBRAZOVATELEY (Integrated Circuits of Analog-Digital and Digital-Analog Converters) in Russian 1978 signed to press 15 May 78 p 2-4, 257

[Annotation, foreword, and table of contents from book by V. G. Balakay, I. P. Kryuk, and L. M. Luk'yanov, Energiya, 20,000 copies, 257 pages]

[Text] The authors discuss basic problems of the creation of integrated analog-digital and digital-analog converters. They classified the main integrated circuits of converters and described the techniques of their manufacturing. They discussed monolithic integrated circuits for the amplification, comparison, and switching of analog signals, as well as hybrid circuits of precision units and the entire converters.

The book is intended for broad sections of specialists working on the development and application of analog-digital equipment and for students of these fields.

Foreword

The present period of scientific and technological development is characterized by a wide use of computers in automatic systems. The main factor in this process is the rapid development of the element resources which are based on integrated circuits (IS) of small (MIS), medium (SIS), large (BIS) and superlarge (SBIS) levels of integration. Integrated designs are used in producing various sets of functional memory, signal converters and commutators, linear SIS and BIS, various types of memory devices, and, finally, microprocessor sets which will play a leading role in creating automatic systems both for new and old areas of application of computers. The introduction of digital computing machinery and microprocessors into automatic systems poses an important problem of connecting them with objects whose parameters in most instances are characterized by values which are continuous time functions. It is impossible to use and process such functions directly in digital devices, and it is necessary to convert analog signals to digital signals. This operation is realized by the analog-digital converter (ATsP). In order to withdraw the results of information processing from the processor and send them to the controlled object, it is necessary to convert digital signals into continuous output signals suitable for work with analog devices and instruments of automatic control systems. This is accomplished by means of digital-analog converters (TsAP).

The advantages of the digital methods of information processing can be realized only when the ATsP and TsAP do not introduce any limitations in this processing with respect to the accuracy and high-speed operation. These limitations can be reduced to a minimum when integrated ATsP and ATsAP are used. The integration of the circuits of the converters did not only improve substantially the economic and realiability indices of ATsP and TsAP and reduce their dimensions with simultaneous improvement of their designs, but also improved the operation speed and the metrological characteristics by reducing stray coupling and by using mutual compensation and identity of individual IS elements. It was impossible to realize many theoretical circuits before (chiefly because it is extremely difficult to combine a large number of analog elements and resistors in a small casing), but now it has become possible due to the development of complex technological processes. All this has expanded sharply the area of application of integrated ATsP and TsAP.

This book examines the present state and tendencies of the development of the technology and element resources of integrated ATsP and TsAP, and shows the level of their parameters which has been achieved and special characteristics of circuit techniques in design and in solving problems of increasing their accuracy and operation speed.

The material of the book refers to converters of signals of direct (current) voltage which are used most widely for transmitting information regarding the parameters of objects in automated systems.

The authors tried to describe new and advanced ideas of the realization of integrated ATsP and TsAP which have appeared in recent years in literature in our country and abroad.

The authors are grateful to the reviewer and the scientific editor, Candidate of Technical Sciences V. B. Kravchenko for his advice and suggestions which determined the systematization of the material in the book and made it possible to improve its quality considerably.

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PUBLICATIONS

UDC 621.396.946

ANTENNA GUIDANCE SYSTEMS OF SATELLITE EARTH STATIONS

Moscow SISTEMY NAVEDENIYA ANTENN ZEMNYKH STANTSIY SPUTNIKOVOY SVYAZI [Antenna Guidance Systems of Satellite Earth Stations] in Russian 1978 signed to press 7 Dec 1977, p 2, 153

[Annotation and table of contents from book by A. M. Pokras, V. M. Tsirlin, and G. N. Kudeyarov, "Svyaz'" Publishers, 3300 copies, 153 pages]

[Text] This book examines the systems for guiding antenna beams of earth stations of satellite communication lines toward artificial earth satellites. It describes antenna devices with various axes of rotation. It analyzes the methods of forming direction-finding radiation patterns for monopulse systems and systems with conical beam scanning for various antennas, including the antenna equipped with a beam mode guide.

The book is intended for engineers and technicians working in the area of satellite radio communication and will be useful to students of vuzes.

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PUBLICATIONS

UDC 536.244

HEAT TRANSFER DURING COOLING OF DISSOCIABLE HEAT CARRIERS IN ATOMIC ELECTRIC POWER PLANTS

Minsk TEPLOOBMEN PRI OKHLAZHDENII DISSOTSIIRUYUSHCHIKH TEPLONOSITELEY AES in Russian 1978 signed to press 6 Dec 77 pp 2-6, 167-168

[Annotation, table of contents and foreword from book by Aleksandr Nikolayevich Devoyno, Izdatel'stvo "Nauka i Tekhnika," 1,000 copies, 168 pages]

[Text] In connection with the development of atomic electric power plants using a dissociable gaseous heat carrier, problems in design and optimization of plant components such as regenerators are an important consideration. Solution of these problems requires a knowledge of the laws governing the heat transfer during cooling of the dissociable heat carrier. The book presents original results of a study made concerning these laws. The heat transfer coefficients which characterize the cooling of a gaseous stream have been found to be much higher when the latter is chemically active than when it is not chemically reacting. This suggests new possible ways to substantially reduce the size of heat exchanger equipment and to lower the total cost of an atomic electric power plant.

The book is intended for scientists, engineers and graduate students engaging in research on dissociable heat carriers and in development of atomic electric power plants with such heat carriers. It has been reviewed by doctor of technical sciences I. T. El'perin and candidate in technical sciences B. Ye. Tverkovin. Tables 21. Figures 36. References 157.

Contents

FOREWORD

The basic directions of national economic growth in the USSR for the 1976-1980 period, as defined by the 25th CPSU Congress, include adding 67-70 million kW of installed electric power, with 13-15 million kW of it in atomic electric power plant capacity, by the end of the current five-year plan period. An accelerated construction and installation of fast reactors has been recommended in connection with it. This is essential to any prospects of developing atomic power as a crucial source of energy in the future. Installation of fast reactors will make it possible to include in the fuel cycle also uranium-238, which occurs abundantly on Earth and yet is unsuitable for use in existing atomic electric power plants with thermal reactors. Furthermore, fast reactors have the ability to breed atomic fuel by converting, for instance, uranium-238 to plutonium-239 usable as a fuel in "second generation" reactors. All this makes the task of installing fast reactors in atomic electric power plants as soon as possible all the more urgent. One decisive factor contributing to the excellent economy and reliability of such atomic electric power plants is the proper choice of heat carrier.

The results of basic research done at the Institute of Nuclear Energy (Academy of Sciences of the Belorussian SSR) have scientifically established the feasibility of using the dissociable nitrogen tetroxide N_2O_4 as an effective heat carrier in atomic electric power plants.

The thermophysical properties of this heat carrier, which are excellent owing to the occurrence of chemical dissociation reactions, ensure a high intensity of heat transfer in components of an atomic electric power plant so that such processes as heat regeneration and condensation in compact heat exchangers become realizable.

Studies made at the Institute of Nuclear Energy (Academy of Sciences of the Belorussian SSR) have shown that a gas-liquid cycle with intermediate heat regeneration works very efficiently in atomic electric power plants using N_2O_4 as the heat carrier. The low latent heat of evaporation of dissociable N_2O_4, namely 5.5 times lower than that of water, makes it feasible to simplify the heat regeneration process in the gas-liquid cycle with N_2O_4, inasmuch as the heat available in the turbine flue gases suffices not only for heating and evaporating the liquid but also for superheating it further to the gaseous state in the regenerator before entrance to the reactor. Occurrence of the $N_2O_4 \rightleftarrows 2NO_2$ dissociation reaction on the high-pressure side of the regenerator, the heat of this chemical reaction being lower than that of the $2NO+O_2 \rightleftharpoons 2NO_2$ recombination reaction on the low-pressure side, contributes to a more nearly complete heat recuperation in gas-liquid cycles with N_2O_4 than in such cycles with water or CO_2 and thus contributes to better thermodynamic performance indicators.

When calculating the parameters of flow in the thermodynamic cycle and the parameters of heat transfer processes in components, especially regenerators, of an atomic electric power plant using dissociable N_2O_4 as the heat carrier, one must account for the kinetics of the chemical reactions, i.e., the time characteristics of dissociation and recombination processes.

According to estimated lengths of time of chemical relaxation, the first stage of the N_2O_4 dissociation reaction ($N_2O_4 \rightleftharpoons 2NO_2$) proceeds at equilibrium over the entire range of practical temperatures and pressures: the time of chemical relaxation here is short (10^{-8}-10^{-6} s), but is long in the second stage of the dissociation reaction ($2NO_2 \rightleftharpoons 2NO+O_2$) and can vary here from 10^{-4}-10^{-3} to 0.1-1 s so that this second stage in many cases proceeds at nonequilibrium.

The rates of N_2O_4 dissociations are proportional to the pressure squared and the rates of recombinations are proportional to the pressure cubed. The rate constant of the $2NO+O_2 \rightleftharpoons 2NO_2$ recombination increases, furthermore, with lower temperatures.

The proper choice of parameters for the gas-liquid cycle, taking into account the temperature range peculiar to the chemical reactions, will almost completely eliminate the effect of reaction kinetics and will yield a strong thermal effect by including the heat of these chemical reactions. For instance, the composition of the gas at the reactor entrance under a pressure of 170.10^5 N/m^2 and at a temperature of 460 K is 40 percent NO_2 and 60 percent N_2O_4. Heating the gas in the reactor to 720 K completes the first stage of the chemical reaction, with 15 percent NO_2 dissociated into NO and O_2. In the process 70 percent of the heat available in the reactor has been expended on chemical reactions and, as a result, the effective specific heat of the gas increases appreciably. On the low-pressure side ($p \sim 20 \cdot 10^5$ N/m^2) of the regenerator the gas coming from the high-pressure turbine is cooled from 600-620 K to 370-390 K and recombination reactions occur in it, with the $2NO+O_2 \rightleftharpoons 2NO_2$ reaction almost completed and the first-stage $2NO_2 \rightleftharpoons N_2O_4$ reaction proceeding to the 50 percent level. At the high-pressure side of the regenerator enters pumped liquid N_2O_4, which then by heating is brought to the gaseous state with thermal dissociation $N_2O_4 \rightleftharpoons 2NO_2$ to the 40 percent level. In the process 70 percent of the heat is transferred to the heat carrier by way of the chemical reactions and thus a high regeneration efficiency is achieved.

Within the flow channel of the high-pressure turbine there occurs an expansion of the gas from $150 \cdot 10^5$ to $21 \cdot 10^5$ N/m^2 and the gas temperature drops from 720 to 570-620 K. The net effect of this process is a drop of the

$2NO+O_2 \rightleftharpoons 2NO_2$ recombination from 15 to 8-9 percent within the turbine flow channel and, as a result, 40 percent of the heat load convertible to actual turbine work appears as the heat of chemical reaction.

In the low-pressure turbine, located behind the regenerator in the thermal loop, the gas composition is determined by the first-stage chemical reaction and 50 percent of the turbine work is attributable to the heat of the chemical recombination reaction $2NO_2 \rightleftharpoons N_2O_4$.

All this indicates that, along with heat transfer during heating and phase transformations, heat transfer during cooling with attendant chemical recombination reactions plays a significant role in components of atomic electric power plants, particularly in regenerators, using a dissociable gas as the heat carrier.

The complexity of this process has compelled us to undertake experimental studies of heat transfer during cooling of a turbulently flowing and chemically reacting $N_2O_4 \rightleftharpoons 2NO_2 \rightleftharpoons 2NO+O_2$ system in a pipe. These studies are important as a basis for verification of existing theoretical models and as a basis of recommendations with regard to a design of regenerators for atomic electric power plants which takes into account the kinetics of chemical reactions.

The results of these studies are presented in this book. The experiments were performed by the author together with V. S. Migrorodskiy and V. N. Stepanenko.

The author acknowledges with thanks the useful advice and the systematic assistance in preparing this monograph given to him by doctor of technical sciences V. B. Nesterenko, corresponding member of the Academy of Sciences of the Belorussian SSR, and by candidate in technical sciences B. Ye. Tverkovkin.

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CSO: 1870

PUBLICATIONS

UDC 621.391.8:621.397.13:621.315.212

TRANSMISSION OF TELEVISION SIGNALS OVER COAXIAL CABLES

Moscow PEREDACHA TELEVIZIONNYKH SIGNALOV PO KOAKSIAL'NYM KABELAM in Russian 1978 signed to press 26 May 78 pp 2-4, 277-279

[Book by Aron Kisel'yevich Oksman, Izdatel'stvo Svyaz', 6,200 copies, 279 pages]

[Text] Principles of designing and constructing systems for long-distance transmission of television programs are examined here. Forms of distortion and interference occurring during transmission of video and audio signals are analyzed, expressions for calculating the interference are derived, and methods of reducing interference as well as distortion are presented. A procedure is established for defining the requirements which linear amplifiers must meet.

The book is intended for engineers and technicians engaging in development, design and operation of television channel equipment. It can also be of use to specialists in transmission of video-telephone and other pulse signals.

Contents

FOREWORD

Communication trunklines in the USSR extensively use coaxial cables. Operation of coaxial-cable transmission systems over a rather wide frequency range provides the possibility to carry on thousands of telephone conversations, to transmit telegraph and facsimile messages, to telecast newspapers and also television programs. Coaxial and radio-relay lines of communication facilitate organization of the widely spread network of interlinked teletransmission centers, facilitate coverage of the very large territory of the USSR with television broadcasts, and facilitate television program exchanges with other countries.

Installation of the improved K-1920U system and the new K-3600 system as well as construction of new trunklines will increase the number of specialists concerned with transmission of television, video-telephone and other pulse signals carrying information. Development of systems with the linear spectrum extending to 60 MHz will make it feasible in the future to organize simultaneous transmission of television programs and video-telephone messages.

This book is the second edition of an earlier one published in 1966. It deals with a set of problems pertaining to long-distance transmission of black-and-white as well as color television signals over coaxial cables. Included are methods of equipping television channels in already operating transmission systems and in still developmental ones. The effect of electrical characteristics of the channels on the quality of signal transmission is analyzed. Distortions occurring during modulation and demodulation of a signal are examined in detail, also possible ways of eliminating them. The basic parameters of modulators and demodulators are calculated. Much attention is paid to methods of improving the interference immunity of transmitted signals, to establishment of the optimum transmission levels for television and telephone signals, and to calculation of the interference immunity of channels. Essential information is given about Soviet-made equipment for television stations and about foreign coaxial-cable television transmission systems.

All these problems apply in some measure to transmission of video-telephone and other pulse signals as well.

The book is intended for specialists engaging in development, design and operation of equipment for television transmission over communication lines.

The author is very grateful to the reviewer, Yu. S. Milevskiy, for the helpful comments made during reading of the manuscript.

Comments about the book are asked to be sent to the editorial offices of "Svyaz'," Moscow 101000, Chistoprudnyy Bul'var 2.

2415
CSO: 1870

PUBLICATIONS

UDC 621.395.7(083.3)

SUBSCRIBER EQUIPMENT IN URBAN TELEPHONE SYSTEMS

Moscow ABONENTSKIYE USTROYSTVA GTS: SPRAVOCHNIK (Manual of Subscriber Equipment in Urban Telephone Systems) in Russian 1978 signed to press 20 Apr 78 pp 2, 271-272

[Annotation and table of contents from book by Yevgeniy Petrovich Dubrovskiy, Izdatel'stvo Svyaz', 15,000 copies, 272 pages]

[Text] Extensive reference material is presented here pertaining to telephone sets and their component parts, coin telephones, equipment at subscriber terminals, pole and rack line equipment, and protective equipment in urban telephone systems. Ways and means of hooking up telephone sets are described, faults in telephone equipment are examined in subscriber wiring as well as along the lines, also methods of fault detection and clearing are outlined.

The book is intended for electricians and electromechanics engaging in technical operation maintenance of equipment in urban telephone systems, for technicians and installers employed by wire-communication systems enterprises, also for instructors and students at professional engineering colleges and technical schools of communications.

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CSO: 1870

PUBLICATIONS

THE ZOYEMTRON-385 AUTOMATED ELECTRONIC CALCULATING MACHINE

Moscow ZOYEMTRON-385: EKSPLAUATATSIYA, PROGRAMMIROVANIYE (POSOBIYA DLYA RABOTNIKOV MASHINOSCHETNYKH BYURO) (Zoyemtron-385: Use, Programming--Textbooks for Employees of Machine Accounting Bureaus) in Russian 1977 signed to press 28 Oct 77 pp 2-3, 110-111

[Annotation, foreward and table of contents from book by V. I. Tikhomirov, Statistika, 25,000 copies, 111 pages]

[Text] The textbook presents the possibilities for using the Zoyemtron-385 electronic calculating machine, the function and rules for programming commands by utilizing punches and reading units, and also variants of programming.

The book is intended for employees in machine accounting bureaus, machine accounting stations, and computer centers. It can also be used as a text book for training programmers and designers.

Foreword

In modern conditions the role of accounting as a function of management providing for development and improvement of socialist production is growing. The requirements for accounting information, the volume of which is constantly increasing, are being raised. The basic direction for improving accounting is its mechanization on the basis of application of keyed, punch, and electronic calculating machines.

The widespread installation and effective use of the technical means of data processing is an urgent task of the national economy, and its successful completion to a large degree depends on qualified application and technically literate service of computer technology.

At the present time the Zoyemtron-382, 383, 384, and 385 electronic computing automatons are widely distributed in the machine accounting installations of the country, being used to mechanize various parts of accounting and computational work, while the Zoyemtron-383, 384, and 385 automatons are used in addition as peripheral machines for the collection of alphanumeric data on punched tape or cards with its subsequent processing on computers.

One of the decisive factors in the rational installation and application of computing technology is preparation and improvement of the qualifications of specialists in the educational combines of the system of the Main Administration for Personnel Training (GUPK) of the USSR Central Statistical Administration, as well as directly under production conditions in machine accounting bureaus, stations, and computer centers.

The present textbook is a logical continuation of the textbook on the use and programming of the Zoyemtron-382 and 383 electronic computing automatons. It can be used in training programmers, designers of keyboard computing machines, operators who use electronic calculating automatons, and mechanics in repair and maintenance of keyboard computing machines in the educational establishments of the system of the Main Administration for Personnel Training of the USSR Central Statistical Administration.

The book is arranged so that it can be of use of those who are improving their job qualifications or are independently studying the use and programming of Zoyemtron-385 automated machines in computer centers, machine accounting stations and bureaus.

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PUBLICATIONS

UDC 621.372

OPTIMAL SYNTHESIS OF LINEAR ELECTRONIC CIRCUITS

Moscow OPTIMAL'NYY SINTEZ LINEYNYKH ELEKTRONNYKH SKHEM (Optimal Synthesis of Linear Electronic Circuits) in Russian 1978 signed to press 29 Jun 78 p 2, 334-335

[Annotation and table of contents from book by Artur Abramovich Lanne, Svyaz', 6000 copies, second edition, revised, 336 pages]

[Text] This book treats the optimal synthesis of electronic circuits. Primary emphasis is placed on stationary linear circuits with concentrated parameters (passive RLC-, RC-, and active RC-filters, correctors, selective amplifiers, shaping circuits, etc). For these circuits, the procedures of optimal synthesis are brought to the level of algorithms, and in the most important cases -- to standard programs. This monograph is characterized by the desire of the author to construct global optimal solutions.

This book is intended for scientists and will be useful to graduate students and engineers specializing in the areas of combination coupling, electric conductive coupling, radio physics, automatic control, measurements, etc.

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PUBLICATIONS

UDC 621.396.62

AUTOMATIC CONTROLS IN RADIO RECEIVERS

Moscow AVTOMATICHESKIYE REGULIROVKI V RADIOPRIYEMNIKAKH in Russian 1978 signed to press 3 Apr 78 pp 2, 4, 86-87

[Annotation and table of contents from book by Sergey Nikolayevich Krize, Izdatel'stvo Svyaz', 55,000 copies, 87 pages]

[Text] The book outlines in concise and popular form the operating principles of automatic control systems widely used in radio receivers: automatic gain control and automatic control of the heterodyne frequency by frequency or by phase. Some schemes for automatic control of receiver bandwidth are also shown. Most attention is paid to the physical aspects of operation of these systems, which are built with diodes, transistors and integrated micro-circuits.

The book is intended for radio mechanics and students of engineering colleges or professional schools, also for qualified radio amateurs.

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FOREWORD

Raising the material standard of the Soviet people in every way, according to the historic decisions of the 25th CPSU Congress, includes a further increase in the production of electronic home appliances with better quality and reliability. A successful solution of this problem is impossible without extensive use of various automatic controls in these appliances: gain control, bandwidth control, control of the heterodyne frequency, etc. The operation of the basic types of automatic control in radio receivers is the subject of this book. Only a small portion of the large problem is, of course, dealt with here. Highly effective automatic control systems are also used in other areas of radioelectronics. Managing the modern production processes, workshops, means of transportation, plants and even entire branches of industry without the aid of automatic control systems would be inconceivable. This fact, although not directly bearing on the problems considered here, clearly indicates the immensity of the task which control systems on the whole are called on to perform. Solution of problems on such a grand scale is possible only with highly developed instrument manufacturing, electronic and radio engineering industries through universal development of means of automation.

The object of this book is much narrower in scope: to examine the basic types of automatic control in radio receivers. Even then, however, the implications of the analysis are in many cases broader. The book does not claim to exhaustively and completely cover the many problems touched upon. It is not intended to serve as an aid in designing the details of automatic control systems for radio receivers, although some mathematical material is given. It should not be regarded as a methodical textbook on radio receivers. It thus is, naturally, intended for readers familiar with radio reception techniques. At the same time, a brief outline of the physical principles underlying the operation of the most essential components in automatic control systems (amplifier stages, filters, etc.) for various applications could not possibly have been avoided.

The simple formulas presented in the text are adequate for calculating the basic parameters of automatic control systems. Their proof is not given here. Appropriate bibliographic references are listed for more thorough calculations, if such should be necessary.

Knowledge about automatic control has been built up over many decades. Many Soviet and foreign scientists have contributed to its growth. An important role in developing the theory of automatic control in radio engineering devices was played by the works of M. R. Kaplan and V. A. Levin, B. Kh. Krivitskiy, I. M. Simontov, N. I. Chistyakov, V. V. Shakhgil'dyan and well as many other authors. And now this progressive branch of engineering still continues developing.

The author thanks lecturer V. S. Mostyko for his participation in writing the fourth chapter. The author also thanks Prof N. I. Chistyakov for writing the fifth chapter, reviewing the book and offering many useful suggestions for improvement.

The author will be grateful to receive any comments about this book. They should be addressed to the editorial office of "Svyaz" Moscow 101000, Chistoprudnyy Boulevard 2.

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CSO: 1870

PUBLICATIONS

UDC 621.391

THEORY OF ELECTROMAGNETIC FIELD COHERENCE

Moscow TEORIYA KOGERENTNOSTI ELEKTROMAGNITNOGO POLYA (Theory of Electromagnetic Field Coherence) in Russian 1978 signed to press 20 Jan 78 p 2, 205-207

[Annotation and table of contents from book by V. A. Potekhin and V. N. Tatarinov, Svyaz', 3000 copies, 208 pages]

[Text] The authors analyze the coherence properties of an electromagnetic field subjected to random spatial and temporal distortions on the basis of a general theory of coherence developed within the framework of the classical electrodynamics and correlational theory of vectorial fields. The obtained results make it possible to evaluate the effectiveness of channel-forming equipment, to find statistical characteristics of signals at the output of receiving antennas, and to synthesize antennas which extract information from a random field most fully.

The book is intended for scientists and engineers specializing in the theory of communication and applied problems.

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PUBLICATIONS

LIST OF SOVIET ARTICLES DEALING WITH COMPOSITE MATERIALS

Moscow GOSUDARSTVENNYY KOMITET SOVETA MINISTROV SSSR PO NAUKE I TEKHNIKE. AKADEMIYA NAUK SSSR. SIGNAL'NAYA INFORMATSIYA. KOMPOZITSIONNYYE MATERIALY in Russian Vol 3, No 7, 1978 pp 1-6

[Following is a listing of the Soviet entries from SIGNAL'NAYA INFORMATSIYA. KOMPOZITSIONNYYE MATERIALY (Signal Information. Composite Materials), a bibliographic publication of VINITI. This listing is from Vol. 3, No. 18, 1978]

[Excerpts] 1. The physicochemical properties and strength characteristics of boron filaments and the prospects of their use for reinforcing composite materials. Zhigach, A. F., Tsirlin, A. M., "Zh. Vses. khim. o-va imeni D. I. Mendeleyeva," 1978, 23, No. 3, 264-272.

2. Composite materials based on thermoplasts. Kuz'min, Yu. G., "Plast. massy," 1978, No. 6, 19-22.

3. The compatibility of carbon fibrous materials with metal matrix. Varenkov, A. N., Kostikov, V. I., Mozzhukhin, Ye. I., Shimanyuk, V. T., "Izv. vuzov. Chern. metallurgiya," 1978, No. 5, 128-131.

4. New Composite materials based on synthetic fiber-filled polyethylene. Brakhim, Z., Budnitskiy, Yu. M., Akutin, M. S., "Izv. vuzov. Khimiya i khim. tekhnol.," 1978, 21, No. 6, 891-893.

5. Investigating the phases formed at high temperatures as a result of diamond-metal interaction. Tsypin, N. V., Simkin, E. S., Kostenetskaya, G. D., "Fiz.-khim. probl. sinteza sverkhtverd. materialov," Kiev, 1978, 144-147.

6. P. A method of thermomechanical treatment of bimetal products. Dovnar, S. A. [Fiz.-tekhn. in-t AN BSSR]. Author's certificate of the USSR, (C 21 D 7/14, C 21 D 1/78), No. 582305, application 13 Aug 76, No. 2396633, published 24 Nov 77.

13. Production of the steel-aluminum bimetal compound by plane and cylindrical surfaces. Arkulis, G. E., Dorogobid, V. G., Makhneva, Ye. K., "Teoriya i praktika pr-va metizov," Sverdlovsk, 1977, 114-116.

14. The effect of asbestos additives on the porosity of dense silicate concrete. Sivkov, S. P., Timashev, V. V., Nikonova, N. S., "Tr. Mosk. khim.-tekhnol. in-ta im. D. I. Mendeleyeva," 1977, No. 98, 90-91.

15. A discrete-matrix model for carbon-carbon composites. Kolesnikov, S. A., "Mekh. polimerov," 1978, No. 3, 387-393.

17. The thermoelectric properties of composite materials. Kudinov, V. A., "Zh. tekhn. fiz.," 1978, 48, No. 6, 1308-1310.

18. Elastic wave propagation in some composites. Abramchuk, S. S., "Mekh. polimerov," 1978, No. 3, 531-536.

20. Efficient designing of reinforced composite shells in stability. Samsonov, V. I., "Mekh. polimerov," 1978, No. 3, 481-484.

25. Experience of using the mathematical planning method in finding optimum conditions for producing filament-like calcium hydrosilicate crystals with chain silicate anions. Nikonova, N. S., Timashev, V. V., Vlasov, A. S., Yevstigneyev, A. R., "Tr. Mosk. khim.-tekhnol. in-ta im. D. I. Mendeleyeva," 1977, No. 98, 64-67.

29. Studying the effect of production factors on the properties of aluminum oxide-molybdenum cermets. Skidan, B. S., Fomina, G. A., Shepilov, I. A., "Poroshk. metallurgiya," 1978, No. 5, 93-96 (English summary).

31. The parameters of the porous structure of permeable materials. II. Metal fiber materials. Kostornov, A. G., "Poroshk. metallurgiya," 1978, No. 5, 63-68 (English summary).

32. Investigating the structure of the weld seam metal of a cladding bimetal layer. Duben', L. V., Steklov, O. I., "Tr. VNII po montazh. i spets. stroit. rabotam," 1978, No. 23, 62-66.

33. Diffractometric study of filament-like crystal distribution in composite elastomers. Gorobets, B. R., Chernyak, A. I., Shchetanov, B. V., "Mekh. polimerov," 1978, No. 3, 550-551.

37. Breakdown of superconducting composites at low temperatures. Parkhomenko, T. A., Pustovalov, V. V., Stepanenko, V. A., "Probl. prochnosti," 1978, No. 6, 108-113.

39. Investigating the hydration processes of sulfoaluminate matrices. Sycheva, L. I., Timashev, V. V., Osipov, V. I., Mironov, V. V., "Tr. mosk. khim.-tekhnol. in-ta im. D. I. Mendeleyeva," 1977, No. 98, 53-59.

40. Studying the oxidizability of molten eutectic composites of Cr_2O_3-Mo and Cr_2O_3-W systems and of calcined materials of the given systems. Pasechnik, G. D., Vlasov, A. S., Yakovleva, E. D., "Tr. Mosk. khim.-tekhnol. in-ta im. D. I. Mendeleyeva," 1977, No. 98, 14-15.

43. Approximate solution of the bimetal molding problem. Smushkevich, L. Ye., "Teoriya i praktika pr-va metizov," Sverdlovsk, 1977, 149-156.

47. Improving the quality of steel-copper wire from the metallurgical method of production. Plugin, A. M., Bazarova, V. Ye., Gorin, N. N., Selezneva, Ye. P., Shadrunova, A. P., "Stal'," 1978, No. 6, 546.

70. The porous space structure of calcareous-siliceous stone under different conditions of formation. Timashev, V. V., Vorob'yeva, M. A., Dyukova, N. F., Ubeyev, A. V., "Tr. Mosk. khim.-tekhnol. in-ta im. D. I. Mendeleyeva," 1977, No. 98, 95-97.

72. The effect of alkaline additives on the properties of lime-based composite materials. Timashev, V. V., Vorob'yeva, M. A., Ubeyev, A. V., Dyukova, N. F., "Tr. Mosk. khim.-tekhnol. in-ta im. D. I. Mendeleyeva," 1977, No. 98, 87-89.

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CSO: 1870

PUBLICATIONS

NEW BOOK DISCUSSES STABILIZATION OF MEASURING DEVICES

Moscow STABILIZATSIYA IZMERITEL'NYKH USTROYSTV NA KACHAYUSHCHEMSYA OSNOVANII (Stabilizing Measuring Devices on Swaying Bases) in Russian signed to press 23 Jun 78 pp 2-4

[Title page, annotation, and table of contents of book by S.S. Rivkin, Nauka -- Glavnaya Redaktsiya Fiziko-Matematicheskoy Literatury, 2,750 copies, 320 pages]

[Excerpts] Title Page

Author: S. S. Rivkin
Title: "Stabilizatsiya Izmeritel'nykh Ustroystv na Kachayushchemsya Osnovanii" [Stabilizing Measuring Devices on Swaying Bases]
Place and Year of Publication: Moscow, 1978

Annotation:

This book sets forth the chief questions of the mechanics of systems to stabilize measuring devices, direction finders and the sensitive elements of navigation and control systems, on swaying bases. The investigation of stabilization systems for these instruments and solutions to applied problems are given with reference to a ship, but the material presented in the book is entirely applicable to measuring device stabilization systems installed in other mobile objects.

The main characteristics of the investigation of measuring device stabilization systems are the use of probability techniques, techniques from the theory of automatic regulation, and the methods of statistical optimization (Kolmogorov-Viner, Kalman, and others).

In addition to the theoretical presentation the book contains solutions to a large number of applied problems from the field of stabilizing measuring devices.

The book is intended for engineering-technical and scientific workers working with questions of stabilizing measuring devices, applied gyroscopy, and automatic control of moving objects. It can also be used by upper division and graduate students in the appropriate specializations.

The book contains 11 tables, 100 illustrations, and 101 bibliography entries.

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PUBLICATIONS

UDC 631.521.633.11

BREEDING SPRING WHEAT

Moscow SELEKTSIYA YAROVOY PSHENITSY in Russian 1977 signed to press 25 Jul 77 pp 2, 153-154

[Annotation and Table of Contents of book edited by N. V. Turbin, Izdatel'stvo "Kolos", 1910 copies, 154 pages]

[Text] The collection deals with the problems of breeding spring wheat, including short-stemmed varieties of the intensive type. The methodology is revealed for breeding spring wheat for drought-resistance and early ripening, and raising the quality of the grain. The biological characteristics of new regionalized and promising varieties are described.

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