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PHYSICAL SCIENCES AND TECHNOLOGY
(FOUO L/79)

1 OF 1

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TRANSLATIONS ON USSR SCIENCE AND TECHNOLOGY

PHYSICAL SCIENCES AND TECHNOLOGY

(FOUO 1/79)

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SCIENTISTS AND SCIENTIFIC ORGANIZATIONS

CYBERNETICS, COMPUTERS AND AUTOMATION TECHNOLOGY

DEVELOPMENT OF THE MAIN MEMORY OF YES EVM

Moscow VYCHISLITEL'NAYA TEKHNIKA SOTSIALISTICHESKIKH STRAN. SBORNIK STATEY in Russian Vol 2 1977 pp 5-10

[Article by Candidate of Technical Sciences N. M. Sharunenko, chief of department of NITsEVT (USSR), from the collection "Vychislitel'naya tekhnika sotsialisticheskikh stran. Sbornik statey" edited by M. Ye. Rakovskiy]

[Text] The last decade has been characterized by significant changes in computer technology and progress is being observed in the field of software, especially in development of operational systems of the component base and technology of computers, the structure and methods of constructing processors and also all types of memory.

Along with introduction of multiprogram operation and time-sharing, the "second generation" has experienced microprogram control and hierarchical memory of computers.

The hierarchical principle of constructing the internal storage, first used during the 1950's, is beginning to be used efficiently only now with the appearance of the zero-access large-capacity buffer storage operating in computation tempo and with improvement of methods of information exchange between the main and buffer storage.

An internal buffer storage (OP) should now have the information capacity of units-tens of Kbytes. We recall that the main internal storage had this capacity in second-generation machines of medium productivity.

The speed of the buffer storage should now comprise tens of nanoseconds and the overall dimensions and consumed power should be minimum, which would permit location of the buffer storage in the processor rack, occupying several percent of its volume in this case.

Besides buffer OP, the use of different low-capacity control internal storage having the same high speed is also provided in the structure of a modern processor.

The microprogram principle of control and accordingly microprogram storage have now begun to be used in all classes of machines, including highly productive machines. As is known, this saves equipment, considerably increases the structural flexibility of the machine, permits one to have a variable instruction system and so on.

Microprogram storage, both as a constant and in some cases as with operational information exchange, may have flexibility up to 100 Kbytes and should be located without fail in the processor rack. The requirement on the speed of these devices is perhaps higher -- it should be within the range of tens of nanoseconds for highly productive computers. The requirement on the packing density of the microprogram storage device components is also high among processor storage devices (ZU) since otherwise delays in connections and contacts will increase impermissibly, which leads to a loss of speed of the working principle of the central processor control.

Thus, the most complex requirements are placed on the microprogram storage among processor storage devices and the maximum attention should be devoted to its optimum design.

The main internal storage is the most complex and expensive subassembly in a hierarchical storage system and until now this type of storage determines the level of development of storage technology as a whole.

The requirements on increasing the information capacity of the main storage from hundreds of kilobytes to tens of megabytes are now being increased. The use of integrated circuits in the storage considerably increases the information capacity of the buffer storage and the actual speed of the storage system approaches the speed of the buffer.

The requirements on reducing the cost of the device increase with regard to the significant increase of the main storage capacity. For example, the storage of a large machine having capacity of 4 Mbytes will cost 2 million rubles, which is unacceptable for the machine as a whole, compared to the traditional cost of the main internal storage (OOP) equal to 5 kopecks/bit for many serial computers.

Another important problem which should be resolved by developers of the main storage with regard to an increase of its capacity is to increase the dependability of the device. This should be achieved first by an additional increase of the efficiency range of modules from which the storage is constructed. Second, efficient correcting codes (of the Hamming code type) must be used when storing information in the storage.

In this case expenditures for redundant equipment in the control device and storage adapter and also an increase of its physical digit capacity are justified. Byte organization of the computing process used in the YeS EVM helps to effectively solve this problem since the checking digits of bytes, usually employed in the processor to check for evenness, may be used in the main storage. It is not always necessary in this case to increase the physical digit capacity of the main storage.

We also note the problems of realizing the main storage from standardized modules of the same type, transfer of some logic operations, for example, such as recording and reading control, and checking and correction of errors to the "processor-storage" adapter, which minimizes the logic functions of the storage modules and contributes to their standardization within the Unified Computer System.

Trends and methods of realizing new requirements on the storage device. Regardless of the class of machine of the improved Unified System, the processor storage should be related to zero-access storage devices. This category includes large buffer storage, microprogram storage, superhigh-speed processor registers (RON), small control storage, protective key storage, auxiliary small buffer stores and so on.

All the enumerated storage devices are joined to the computer and central control device into a single structural subassembly to increase the speed of information exchange and processing in the processor for the purpose of minimizing communications delays.

The hierarchy of a computer internal storage is constructed so that the effective information volume of the main buffer storage is equal to the OOP capacity and the effective speed of information exchange of the main storage with the processor approaches the speed of the main buffer. This is achieved by page organization of the information file stored in the memory and by segment or block exchange of information between the buffer and OOP. The property of the cyclic nature of programs with multiple access to the same group of addresses, frequently inside a page, is realized in this case. The greater the number of page segments placed in the buffer from the OOP, the closer its effective cycle is to the computer cycle.

The machine operates in the multiprogram mode. Page segments from different problems should be placed in the buffer to achieve maximum productivity and, consequently, the buffer storage capacity should be sufficiently large. There is a connection of the buffer capacity to the main storage capacity which determines the effectiveness of multiprogram operation of the computer. However, the upper range of the main buffer capacity should be selected on the basis of economic concepts in realization of satisfactory probable "percent success" at the moments of access to the buffer for different program situations.

Based on the need to fulfill these requirements, the buffer storage capacity should be within the range of 8-32 Kbytes, depending on the class of machine and the capacity and speed of the OOP.

The buffer storage cycle should not be less than 100 ns and should essentially not depend on the class of machine of the YeS.

There is no doubt of the use of bipolar integrated storage microcircuits as components of the buffer and other devices of the processor storage during the next decade. This is achieved in the buffer device by using bipolar microcircuits with integration of 128-256 bits in the housing and with selection time of less than 45 ns. An example of this microcircuit is the ESL microcircuit 500RU410 with integration of 256 bits. The design of the buffer storage should be completely identical to that of the processor subassemblies, in which the module is a typical replacement component (TEZ). Solution of the problem of heat dissipation in processor storage devices of all types requires a great deal of attention since this may affect the design principle of the processor as a whole.

Bipolar microcircuits with integration of 64 bits in the housing may be used for fast registers and small buffer and control storage, which should have higher speed compared to the main buffer. The ESL microcircuit 500RU48 with access time of 15 ns may be presented as an example.

High requirements on microprogram storage, which was discussed in detail above, limit the selection of integrated microcircuits. A microcircuit with integration of a minimum of 1,024 bits in the housing is suitable to realize a microprogram storage with capacity up to 100 Kbytes built into the processor. An electrically programmed microcircuit of a permanent storage of type 500IP49 with typical access time of 25 ns and integration of 1,024 bits may be considered as an example for constructing a permanent microprogram storage. The ESL microcircuit 500RU415 with integration of 1,024 bits, having access time of 45 ns, may be considered for a microprogram storage with operational information exchange.

This speed is inadequate for highly productive machines. Microcircuits having access time of not more than 20 ns are required.

One may assume that a bipolar storage microcircuit with integration of 1 Kbit or more per housing with access time of less than 15 ns will be used in the future in all processor storage devices of highly productive computers of the Unified System.

The main internal storage. Microferrites will be the main storage components in the memory of large-series machines of the YeS in the near future. The presently developed production capacities permit one to have lower cost of ferrite stores compared to the cost of other types of magnetic storage.

The use of a rapid-access buffer storage of increased capacity in modern computers temporarily reduced the requirement on the speed of the main internal storage, which was discussed above. This in turn altered the tendency in ferrite OP to constantly reduce the core diameter in new developments to achieve high speed of the storage device each time.

A cycle of 0.7-1 ms and access time of 0.3-0.5 ms are easily realized on cores with diameter of 0.45-0.6 mm. Therefore, the main problem of the developers of a ferrite internal storage should include finding economical design-production solutions for constructing stores using completely integrated, but inexpensive electronics. Expenditures for checking operations and electronic framing subassemblies: microcircuits, printed cards and structural components, rather than cores and wiring now comprise the main fraction of the cost of ferrite storage devices.

The polemics of developers in selecting the system of organizing the ferrite storage, which depends in each specific case on the purpose and capabilities, has now lost its sharpness. The 3D system has become most widespread in three-wire stores. Positive experience has been accumulated in realization of the OP of the YeS EVM by a 2 1/2D system, which has increased speed and therefore permits one to use cores of somewhat greater dimensions, which facilitates wiring.

The appearance of microcircuits of medium degree of integration for construction of completely integrated framing of OP permits one to realize two-wire stores by 2 1/2D and 2D systems, which finally eliminates the problem of wiring. However, main attention should be concentrated on improving the module designs of ferrite OP.

Thus, it was possible to achieve an information capacity of 2 Mbytes (the minimum complete set of OOP) in two standard racks of the YeS-3206 together with the electric power supply upon conversion to the modular principle of constructing the main internal storage blocks of the YeS-1060 machine. The microsecond cycle was realized in the YeS-3206 on cores 0.6 mm in diameter in modules with capacity of 64 Kbytes with three-wire planar store constructed by the 2 1/2D system.

It should be noted for comparison that when making up a set of complete storage of the same capacity with YeS-3203 racks (from the YeS-1030 computer), 16 of them would be required.

The use of modular designs of ferrite ZU in new models of the YeS EVM permits a significant change of expenditures in large-series production, significantly simplifies operation and increases the dependability of the main internal storage. The "facilitated" logic of the standardized module permits easy use of it in various types of computers of the Unified System and rigid standardization of the "storage-processor" interface for models of different productivity is not required in this case.

The following step yields a significant technical-economic effect -- conversion to totally planar design of the ferrite stores of YeS. The length and number of connections can be reduced sharply and wire installation can be completely eliminated by a certain increase in the dimensions of printed-circuit cards, which comprise the basis of the design, and more compact installation of cores in the store. The potentials of the power supply sources with an overall reduction of consumed power are decreased in this case. Conversion to a planar design permits configuration density up to 100-120 bits/cm^3 in the internal storage module. This means that an OOP with electric power supply with capacity of 4-6 Mbytes may be located in the rack of the Unified System for a highly productive machine and that the main storage can be placed in the processor rack in a machine of medium productivity. The specific cost of these ZU should not be greater than 0.3-0.5 kopecks/bit.

Semiconductor main internal storage will compete with the ferrite storage, which was discussed above, as serial production is developed and the cost of MOP microcircuits with integration of 4,096 bits in the housing is reduced. The density of packing the storage elements in the rack of this semiconductor storage may exceed 100 bits/cm^3. The K565RU1A microcircuit may be considered as an example for construction of this storage.

An internal storage with capacity of 8 Mbytes in the rack of the YeS, constructed on these circuits, has an access cycle of not more than 800 ns and access time of not more than 600 ns with consumed power of not more than 4 Kw.

It is natural that a modular design is also used in a semiconductor storage. Therefore, an internal storage with capacity of 0.5-2 Mbytes in the form of one-two panels of the YeS may be built into the processor cabinet in medium-capacity YeS machines.

Completion of development and serial introduction of MOP microcircuits with integration of 16 Kbits in the housing will make it possible to have the internal storage of the YeS EVM built into the processor rack. We feel that this coincides in time with the active phase of completing conversion from ferrite to semiconductor integrated ZU.

Future OP. One should expect the appearance of a storage which we shall call multilevel in the 1980's. This device will have a very large capacity (up to 10^{11}-10^{12} bits) and hierarchical organization with unified design formulation and speed equal to that of the buffer ZU. The main store of the multilevel OP may be either electrooptical with the holographic or bit principle of information storage or cathode-ray with energy-independent storage medium. The use of charge-coupled devices (PZS) or a medium with controlled cylindrical magnetic domains (TsMD) in the main store is not excluded. It is also clear that rapid storage blocks of a multilevel OP will be made exclusively on semiconductor microcircuits with high degree of integration.

The use of a multilevel internal storage of this type requires review of the structure and perhaps of the operating principle of computers. The appearance of OP using tunnel cryotrons may be predicted at the end of the 1980's. This OP will obviously have a degree of integration identical to semiconductor storage, with higher speed and very low consumed power.

6521
CSO: 8144/0340

CYBERNETICS, COMPUTERS AND AUTOMATION TECHNOLOGY

SOLVING PROBLEMS OF COMPATIBILITY WHEN USING YES-A527 AND YES-A528 DISK CHECKING PACKETS

Moscow VYCHISLITEL'NAYA TEKHNIKA SOTSIALISTICHESKIKH STRAN. SBORNIK STATEY in Russian Vol 2 1977 pp 39-46

[Article by Candidate of Technical Sciences Zh. Paskalev, senior scientific worker of IVT (Bulgaria), and mechanical engineer I. Ivanov, office chief of the storage device plant (Bulgaria), from the collection "Vychislitel'naya tekhnika sotsialisticheskikh stran. Sbornik statey" edited by M. Ye. Rakovskiy]

[Text] An increase in the capacity of interchangeable magnetic disk stores is achieved by two methods: by increasing the longitudinal recording density and by increasing the number of tracks. Both methods lead to an increase of requirements on the adjustment accuracy in providing compatibility.

One of the most important problems in production and operation of devices with interchangeable disk packets is compatibility, i.e., the possibility of correctly reading the information on a given store that is recorded on another store and vice versa. Two types of adjustments of the floating magnetic heads of the stores: tangential -- with respect to the direction of motion of the heads -- and radial -- with respect to the accuracy of positioning the head on a given track -- are made to provide compatibility.

Tangential adjustment is carried out at the manufacturing plant. The plant guarantees retention of tangential adjustment when a defective head is replaced. The tangential adjustment is checked by using a checking packet. The problems related to radial adjustment of floating magnetic heads will mainly be considered in this article.

The YeS-A527 six-disk checking packet. The configuration of the gaps of the magnetic heads and tracks for stores with six-disk interchangeable packet (of type YeS-5052) is given in the standard ISO/DIS-2864. There are 10 each floating magnetic heads on each store which form two rows of 5 each or both sides of the plane passing through the spindle access. The access mid-line is formed at the intersection of this plane with the disk surfaces. The heads are moved parallel to this line during positioning.

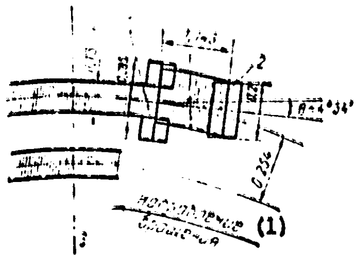

Figure 1. Arrangement of Gaps of Head on Track: 1 -- tunnel erasure gap; 2 -- record-read gap; 3 -- access mid-line

KEY: 1. Direction of rotation

Each head has two working gaps (Figure 1): a record-read 2 and tunnel erasure 1. The tunnel erasure gap consists of two parts. It is obvious that the width of the track (the recording trace on the disk surface) with 0.2 mm immediately after the record-read gap is limited by the tunnel erasure gap to 0.13 mm. Arranging the gaps of the heads to the right (type A) and to the left (type B) from the access mid-line 3 is shown in Figure 2, where F_A = 10.861 mm, F_B = 11.999 mm and θ = 4°54'.

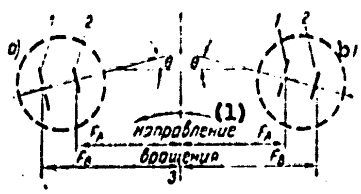

Figure 2. Different Positions of Head Gaps With Respect to Access Line: a -- type B head; b -- type A head; 1 -- tunnel erasure gap; 2 -- record-read gap; 3 -- access mid-line; F_A = 10.861 mm; F_B = 11.999 mm; θ = 4°54'

KEY: 1. Direction of rotation

Any of the tracks on the disk packet is finally formed after the tunnel erasure. Therefore, the mean value of the outer and inner radii of the ring which is the recording track on the disk surface is taken as the track radius. Since the mid-points of the tunnel erasure gaps of the left and right heads are located at different distances from the access mid-line, the track radii will also be different for type A and type B heads. The only track for which the radii of the left and right heads coincide is track 073. One may conclude from this that there is only one real cylinder -- 073 -- on the disk packet and all the remaining cylinders are arbitrary.

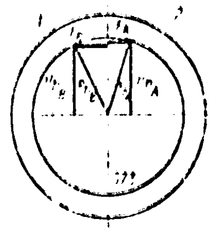

Figure 3. Positioning of Heads on Cylinder 073: 1 -- mid-point of gap of erasing head B; 2 -- mid-point of gap of erasing head A

Step S to which the heads are moved during positioning is constant and is equal to 0.2567 mm. It is obvious from Figure 3, where the positioning of the heads on cylinder 073 is shown, that radius R_n of longitudinal track n is not a linear function of spacing and is expressed by the formulas [2]:

$$R_{n_A} = \frac{F_A}{\sin\left(\operatorname{arctg}\frac{F_A}{H_{n_A}}\right)}$$

and

$$R_{n_B} = \frac{F_B}{\sin\left(\operatorname{arctg}\frac{E_A}{H_{n_B}}\right)}.$$

The distances H_{n_A} and H_{n_B} are calculated by the formulas:

$$H_{n_A} = H_{73} + (73 - n)\,S,$$
$$H_{n_B} = H_{73} + (73 - n)\,S.$$

The value of the radius of cylinder 073 is given as P_{73} = 146.507 mm in the standard ISO/DIS-2864, from which it is easy to calculate H_{73_A} = 146.1039 mm and H_{73_B} = 145.9141 mm from the values of F_A and F_B.

Radial adjustment of the magnetic heads consists in precise setting of them on track 073, which is determined by the playback signal. According to the concepts indicated above, the signal for radial adjustment is taken from the tunnel erasure winding by a special adapter, which is connected between the head and the read preamplifier, rather than from the read winding.

A new method of signal recording for radial adjustment of the floating heads is used in the checking packets produced in Bulgaria, which consists in the following. A series of pulses and pauses (Figure 4) are recorded alternately

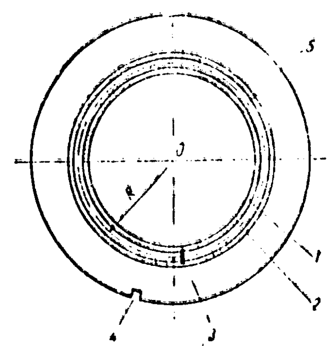

Figure 4. Arrangement of Series of Pulses and Pauses on Tracks: 1 and 2 -- auxiliary tracks; 3 -- head; 4 -- index groove; 5 -- adjusting track

on two concentrically arranged auxiliary heads 1 and 2, equally separated from pre-selected adjusting track 5. Auxiliary heads 1 and 2 are located at a distance from the mid-line of adjusting track 5 that the gap of the head 3 encompasses part of tracks 1 and 2 with approximate adjustment of it. When these parts are identical, head 3 is correctly adjusted. Engagement of the parts of the outer and inner tracks are judged by signals induced in the head winding. An image similar to that shown in Figure 5 is observed on the oscillograph screen upon synchronization due to index groove 4 and with rough adjustment of the head. This image is obtained if the gap head encompasses the greater part of the inner auxiliary track 1 and the outer auxiliary head 2 to a lesser extent [1] (see Figure 4).

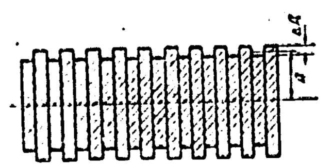

Figure 5. Shape of Signals on Oscillograph Screen

The inaccuracy of head adjustment can be determined by the formula

$$S = \frac{\Delta A}{A} \text{ micron.}$$

If wobble is essentially absent in the store spindle and if the head is correctly adjusted, a rectangular image is observed on the oscillograph screen (Figure 6). Slight deviations from a rectangular image due to macro-unevennesses of the magnetic coating of the disk usually occur, but they are very insignificant and do not affect adjustment accuracy.

A very important advantage of the method, besides high sensitivity and good clarity, is the possibility of determining dynamic wobble of the spindle. If there is wobble, an image similar to that shown in Figure 7 is visible on the oscillograph screen. The location of subassemblies B and C is related to the relative positions of the spindle and index groove eccentricity. Spindle wobble (double eccentricity) is determined by the formula

$$2e = 50 \frac{\Delta A}{A} \text{ micron.}$$

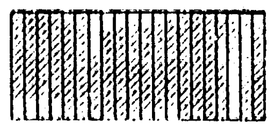

Figure 6. Shape of Signal on Oscillograph Screen With Proper Adjustment

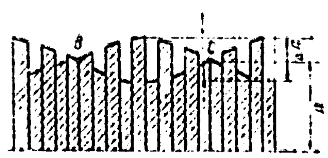

Figure 7. Shape of Signal on Oscillograph Screen in the Presence of Wobble

The case when radial adjustment is made without an adapter (the signal is obtained from the winding of the record-read head rather than from the winding of the erasing head) is of interest. Let us consider how this adjustment affects positioning accuracy [4].

The radii of the circles which are described by the mid-points of the record-read gaps during rotation of the disk packet, are denoted by W_{73A} and W_{73B}, respectively, in Figure 8, where the position of the heads on track 073 is shown. In view of the fact that in the general case $R_{n_A} \neq W_{n_A}$ (accordingly, $R_{n_B} \neq W_{n_B}$), one can state that adjustment of the heads without an adapter introduces an incorrectable error into the accuracy of positioning the heads with respect to the geometric radius of the head.

If the origin of the coordinate system is placed at the center of rotation of the disk packet, one can write that the mid-points P_{1A} and P_{2A} (and accordingly P_{1B} and P_{2B}) of the head gaps will have the following coordinates:

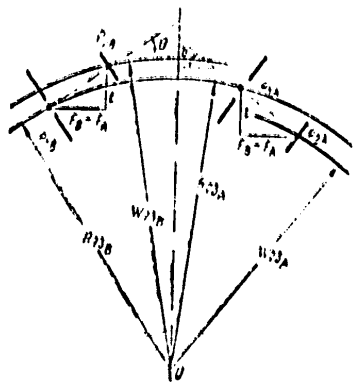

Figure 8. Position of Heads on Track 073

$$x_{1A} = F_A;\quad y_{1A} = \sqrt{R_{nA}^2 - F_A^2};$$
$$x_{2A} = F_B;\quad y_{2A} = y_{1A} - t;$$
$$x_{1B} = -F_B;\quad y_{1B} = \sqrt{R_{nB}^2 - F_B^2};$$
$$x_{2B} = -F_A;\quad y_{2B} = y_{1B} + t.$$

Radii W_{n_A} and W_{n_B} are calculated by the formulas:

$$W_{n_A} = \sqrt{(F_B)^2 + \left(\sqrt{R_{nA}^2 - F_A^2} - t\right)^2};$$
$$W_{n_B} = \sqrt{(F_A)^2 + \left(\sqrt{R_{nB}^2 - F_B^2} + t\right)^2},$$

where $t = (F_B - F_A)\,\mathrm{tg}\,\Theta = 0.097561$.

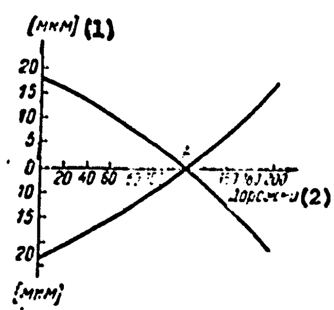

Figure 9. Determination of Track With Zero Error

KEY: 1. micron 2. Tracks

The error which is obtained during radial adjustment without an adapter is equal to the difference ($W_{n_A} - R_{n_A}$) (and accordingly $W_{n_B} - R_{n_B}$). If track 073 is used as the adjusting track, the error will be 8.5 microns. The error also varies nonlinearly due to the nonlinear dependence of radius R_n on spacing S, reaching its maximum value of 18 microns on the outer tracks 000 and 202 (Figure 9).

Point A (Figure 9) indicates the track where this error is equal to zero: $R_{n_A} = W_{n_A}$ (and accordingly, $R_{n_B} = W_{n_B}$). This is a case when the straight line connecting the mid-points of the gaps of the record-read and erasure heads becomes a chord which serves as the base of an equilateral triangle with the apex at the center of the disk.

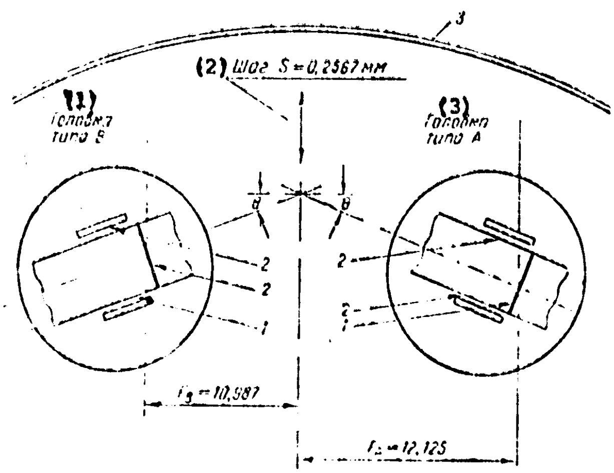

Figure 10. Arrangement of NSMD Magnetic Heads of Type A and Type B: 1 -- slits of record-read heads; 2 -- band of erasing heads; 3 -- disk

KEY:

1. Type B head
2. Spacing
3. Type A head

The YeS-A528 11-disk checking packet. The configuration of NSMD floating magnetic heads YeS-5061 with capacity of 29 Mbytes is determined by standard ISO/DIS-3564. The arrangement of type A and B heads on the right and left of the access mid-line is shown in Figure 10. Recording is accomplished on the tracks by the working slit of the record-read head 1, but final formation of the width and arrangement of the tracks is determined by the bands of erasing head 2. Similarity of tunnel erasure in NSMD YeS-5052 is achieved. The difference is that the signal read from the winding of the erasing head cannot be used here for radial adjustment [3].

A more detailed drawing (Figure 11) with the dimensions of the head elements shows that the poles of erasing head 2 are located very close to the slit of the record-read head.

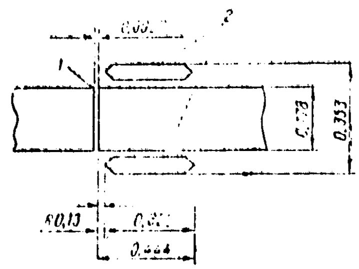

Figure 11. Real Dimensions of Head: 1 -- gap of record-read head; 2 -- strip of erasing head

Track 073 is also determined as the adjusting track for YeS-5061 store. Since the adjustment signal is taken from the record-read head, an incorrectable error is introduced into the radial adjustment, which reaches 3.5 microns for the outer tracks 000 and 202 due to the close proximity of the record-read slit to the poles of the erasing head. How is the radius of arbitrary track R_n actually determined? A model which reflects the head configuration (Figure 12): point A is the mid-point of the slit of the record-read head; point M is the "mid-point" of the erasing head (this is an imaginary point which is introduced for better understanding of the track geometry); MP is a straight line along which point M moves during search and it is parallel to access mid-line)); point N determines the radius of track 0.73; and F_M is the distance from access mid-line to point M, is compiled to determine it.

The following functions follow from Figure 8:

$$NP = \sqrt{R^2_{A73} - F^2_M}, \quad (1)$$

$$MP = NP + S\,(73 - n), \quad (2)$$

$$R_{A_n} = \sqrt{MP^2 + F^2_M}, \quad (3)$$

where S = 0.2567 mm is the spacing of the gear rack to which the heads are mechanically attached to the given track; n is the number of the track whose radius is calculated (n = 0-202); and R_{A73} = 148.057 mm is the radius of track 073.

Let us substitute expression (1) into (2), then

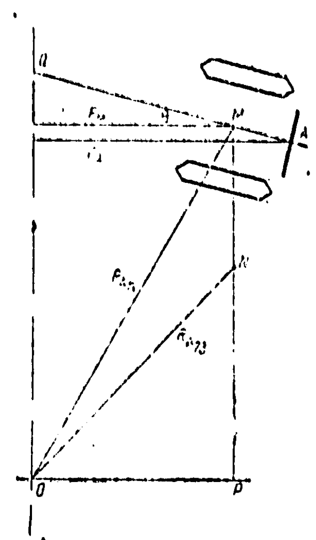

Figure 12. Model Reflecting Head Configuration

$$MP = \sqrt{R_{A73}^2 - F_M^2} + S\,(73 - n). \qquad (4)$$

Let us now substitute expression (4) into (3):

$$R_{A_n} = \sqrt{[\sqrt{R_{A73}^2 - F_M^2} + S(73 - n)]^2 + F_M^2}. \qquad (5)$$

Based on the values established in standard ISO/DIS-3564 and after small computations, we find F_M = 11.923 mm.

The radius of the arbitrary track may now be calculated:

$$NP = 147{,}5757 \text{ мм};$$
$$MP = 147{,}5757 + 0{,}2567\,(73 - n);$$
$$R_{A_n} = \sqrt{MP + 142{,}1704}.$$

The track radius for type B heads on the left of the access mid-line is also determined in similar fashion.

The method of recording the signals for radial adjustment of floating magnetic heads used in the Bulgarian checking packets has the following advantages compared to the method used by IBM and BASF companies:

higher sensitivity (the same deviation of a given head from precise adjustment yields less variation of the image on the oscillograph screen than when using the IBM packet);

better clarity (adjustment accuracy is easier to determine).

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CYBERNETICS, COMPUTERS AND AUTOMATION TECHNOLOGY

DISK SUBSYSTEM OF 29 MBYTES

Moscow VYCHISLITEL'NAYA TEKHNIKA SOTSIALISTICHESKIKH STRAN. SBORNIK STATEY in Russian Vol 2 1977 pp 72-77

[Article by B. Drumev, scientific worker grade 1, IVT (Bulgaria), M. Terpesheva, scientific worker grade 2, IVT (Bulgaria), Kh. Rashev, scientific worker grade 2, IVT (Bulgaria) and S. Denchev, scientific worker grade 2, IVT (Bulgaria) from the collection "Vychislitel'naya tekhnika sotsialisticheskikh stran. Sbornik statey" edited by M. Ye. Rakovskiy]

[Text] The 29-Mbyte disk subsystem is designed to operate in models of the YeS EVM and is an external magnetic disk storage with direct access and high capacity. The subsystem configuration contains the YeS-5561 store control device (UU), YeS-5061 stores (NSMD) and YeS-5261 magnetic disk packets or ones equivalent to them.

Complex delivery of the 29-Mbyte system has significant advantages compared to delivery of individual devices. The supplying plant of the subsystem bears complete guarantee and service responsibility for the subsystem as a whole. Delivery of the subsystem guarantees considerably higher quality and dependability of the devices contained in it compared to the variant of delivery and joining of individual devices. The presence of operational documentation for the subsystem optimally ties in the complete set of ZIP [spare parts], the service apparatus and complex of maintenance programs (KPTO) and also routine maintenance. The presence of standards for interfaces between devices permits expansion of each specific subsystem by connecting the stores or one or another type which meet the corresponding requirements.

The 29-Mbyte disk subsystem has the following main characteristics:

individual store capacity -- $29.2 \cdot 10^6$ bytes;

maximum capacity of the subsystem -- $233.6 \cdot 10^6$ bytes;

speed of data exchange with the channel -- 312 Kbytes/s;

three-phase power supply of the subsystem -- 380/220 V, 50 Hz, and consumed power of not more than 9 kV·A (for maximum configuration).

The 29-Mbyte disk subsystem consists of a single control device with the possibility of connecting from one to nine NSMD. A maximum of eight NSMD is logically connected to the channel. One of the stores may be identified as a reserve. It operates autonomously with the UU.

Each store has a single access mechanism carrying 20 magnetic record-playback heads, by means of which access to data recorded on the replaceable disk packet is achieved. The interchangeable magnetic disk store control device (YeS-5561) logically connects the store addressed by the input-output instruction to the channel, performs a sequence of operations given by the input-output instruction, exchanges data between the channel and the selected store, checks the reliability of data during the exchange and presents information about the state of the selected store to the channel. The interchangeable magnetic disk store (YeS-5061) sets the access mechanism, selects the necessary record-playback head, records and plays back data and accomplishes the possibility of the security of data located in the packet. The YeS-5261 interchangeable magnetic disk packet stores information recorded on the magnetic surfaces. The data recorded on the packet may be read in any store.

Information is recorded and played back from the magnetic surfaces of the interchangeable disk by means of 20 record-read heads. The heads arranged vertically are moved by the access mechanism. They float above the disk surface in the working state.

The interchangeable packet contains 203 concentric information cylinders, 200 of which are working and 3 are reserve. Information is recorded or played back from one cylinder without displacing the access mechanism. The density of data recording on cylinder 000 is 60 bits/mm and that on cylinder 202 is 90 bits/mm. The average access time is 50 ms, the maximum is 80 ms and the minimum is 20 ms.

The 29-Mbyte disk subsystem uses a data format which completely corresponds to ISO requirements. Organization of the track and recording on the track are the same as in 7-Mbyte disks.

The YeS-5261 interchangeable disk packet is completely interchangeable with those of foreign companies such as IBM, BASF, MEMOREX and so on.

Exchange of data with the computer channel is byte-by-byte in parallel -- eight information bits and one checking bit. Exchange of data with the stores is in series bit-by-bit. The checking bit is not recorded on the disk surface. It is formed by the control device during readout.

The problem of parallel-series conversion of information is contained in the UU function of the subsystem.

The control device calculates two checking bytes, which are added at the end of each recording, when recording data on the packet. The correctness of information playback is checked by new calculation of the checking bytes and by comparison of them with the checking bytes recorded on the track. These checking bytes are calculated as an inversion of the remainder of dividing the information bytes in a given recording by the polynomial $1 + x^{16}$.

The control device adds an additional byte (byte BC) after the checking bytes. It is calculated as inversion of the total number of bits (modulo 256) of the synchronous byte, the information bytes and the first checking byte of the given recording. Byte BC is again calculated and compared to the recorded byte when reading data.

The checking bytes and byte BC are not entered in the input-output channel. The 29-Mbyte disk subsystem performs the entire set of operations required for operation of the DOS and OS operational systems.

At the same time the subsystem has the following characteristic features:

- it is possible to carry out multitrack instructions of the read and search type;

- recording and processing of a transient recording are possible.

instructions of type "Continue scanning" are performed which are used to process the transient recording on the defect or reserve track;

six bytes of the refined state, which retain information about the type of malfunction, are formed in cases of malfunctions;

The possibility of moving these recordings along the track is provided when defects are detected in the domains of the natural address and recording R0;

there is the possibility of reserving the stores for working only with a single channel for the time while the channel making the reservation releases the stores when the subsystem is connected to two input-output channels.

The 29-Mbyte subsystem is connected to the selector channel of the Unified System computer through the standard input-output interface of the YeS EVM. The channel capacity should not be less than 312 Kbytes/s.

Since the control device is two-channel, there is the possibility of access to the subsystem stores either from two channels of a single computer or from a single channel of each of two different computers. The stores are reserved and released by the channel through the control device.

The input-output channel selects the given store by means of its logic address. The logic address of the store is given by the logic address box which is located on the front panel of the store. The logic address is changed by simple replacement of this box.

Moreover, each store is characterized by its own physical address. The physical address determines the real store in the subsystem. The control device transmits the physical address of the store to the channel in the fourth byte of the refined state.

The microprogram principle of realizing the control device of the subsystem permits one to rapidly check in sufficient volume, without additional equipment and test programs, the correct functioning of the subsystem.

There are three levels of microprogram diagnostics:

scanning the continuous recording device of the subsystem UU;

checking the executive logic of the subsystem control device;

checking the correct functioning of the stores together with the UU.

Microinstructions are read sequentially in the scanning mode. In this case a check is made for the oddness of the address and of the contents of the microinstruction.

Microdiagnostic tests stored in the continuous recording device of the UU are used to check the efficiency of the executive logic. The following UU equipment can be checked by using these tests: the arithmetic-logic device (ALU), the common register block, the microprogram conversion block and the SW register block.

Operation with the stores is also checked by using built-in microdiagnostic tests. These tests are designed to work with the reserve store to which logic address "S" is assigned. It is important to note that they can be carried out identically both in the autonomous mode to check the efficiency or to find malfunctions and in the systems mode, without interfering in this case with the joint operation of the subsystem and channel.

Performing the microdiagnostic tests in the systems mode is possible only when the subsystem is free of performing channel programs. The procedures of loading and performing the tests are identical in both modes.

All three types of microprogram diagnostics are organized so that a luminous display of the error code is shown on the engineer's console of the control device if errors are detected.

The 29-Mbyte subsystem is delivered to the user together with test programs for functional checking of the efficiency of devices in the computer system. The test programs check the correctness of performing instructions by the stores, joint operation of the NSMD-UU-computer and two-channel operation of the subsystem UU. The test programs operate under the control of the test monitor of the DMES Unified System.

The software for the 29-Mbyte subsystem is contained in DOS 2.0 and OS 4.0. The 29-Mbyte subsystem is designed according to the requirements of the Unified Computer System using type TTL integrated circuits. Development of the 29-Mbyte disk subsystem is a further step in development of external disk storage devices.

The most important advantages of the 29-Mbyte disk subsystem compared to the 7-Mbyte subsystem consist in the following:

the capacity of the subsystem has been increased fourfold with an equal number of NSMD;

organization of recording on the track is identical to 7 Mbytes, while the track capacity is two times higher -- 7,294 bytes;

the number of cylinders is the same as in the 7-Mbyte system, but the number of tracks within the framework of a single system is two times greater, i.e., 20;

the speed of data exchange with the channel has been increased twofold -- up to 312 Kbytes/s;

the subsystem provides long time to the channel for completing the instruction chain;

the subsystem permits processing of the transient recording on the defect or reserve track;

checking exchange of data is more efficient -- an additional checking byte has been added at the end of each domain (byte BC);

changing the logic address of the store is very simple;

transfer of the physical address of the store to the channel permits the computing system to tabulate error statistics for each store;

the diagnostic equipment makes it possible to check and adjust each store during operation of the subsystem with the computer if logic address "S" is assigned to it;

the control device has interface signals with parameters corresponding to the requirements of the improved input-output interface so that a disk subsystem of 29 Mbytes can be connected in the model of the improved YeS EVM.

The 29-Mbyte subsystem has been in serial production since 1976. It is supplied in five standard configurations, including 2, 3, 4, 6 and 9 NSMD. Functional testing on joining the subsystem to models of the YeS EVM were successful and proved its operating efficiency within these models.

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CYBERNETICS, COMPUTERS AND AUTOMATION TECHNOLOGY

INFORMATION ON NEW HARDWARE OF THE YES EVM

Moscow VYCHISLITEL'NAYA TEKHNIKA SOTSIALISTICHESKIKH STRAN. SBORNIK STATEY in Russian Vol 2 1977 pp 162-168

[Article from the collection "Vychislitel'naya tekhnika sotsialisticheskikh stran. Sbornik statey" edited by M. Ye. Rakovskiy]

[Text] The YeS-1060 Computer

The YeS-1060 computer is related to the class of high-speed computers, is program-compatible with computers of the Unified System and is designed to solve a wide range of scientific-technical, economic and special problems. The speed of the YeS-1060 computer is 1.3 million operations/second. A block diagram of the YeS-1060 is presented in Figure 1.

Unlike the previous computers of the Unified System, additional hardware which increases the efficiency of systems use of the computer have been introduced into the YeS-1060 machine. These devices include a virtual memory, instruction repetition devices in the processor, expanded set of instructions (up to 183), expanded interruption system, astronomic time clocks, recording of program events, increased accuracy of calculations with floating decimal and a diagnostic system which localizes malfunctions with accuracy up to the group of interchangeable blocks.

The presence of a virtual memory permits the programmer to use up to 16 Mbytes of addressable memory in his program. Page organization of the memory by request provides additional conveniences to the user. The virtual memory accelerates the process of program preparation and simplifies the structure of the programs themselves.

The central device of the machine which provides organization of the computing processor is the YeS-2060 processor (Figure 2).

The processor includes: central control blocks, an arithmetic block, memory control block, checking and diagnostics block and control console. The apparatus-microprogram principle of control is used in the processor.

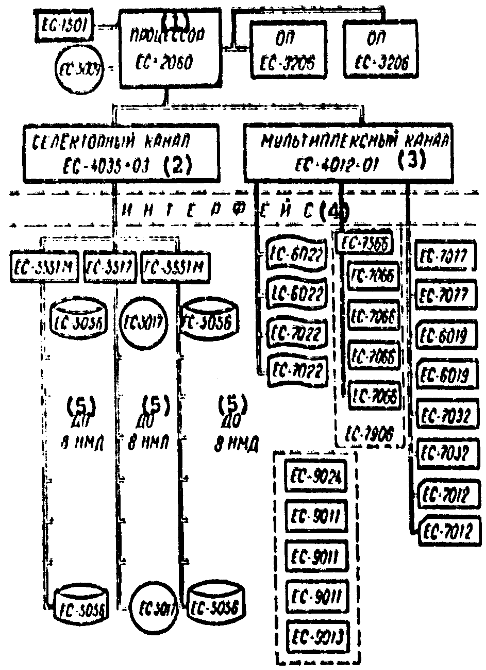

Figure 1. Block Diagram of YeS-1060 Computer

KEY:

1. YeS-2060 processor
2. YeS-4035-03 selector channel
3. YeS-4012-01 multiplex channel
4. Interface
5. Up to

Pre-machine instructions are processed during a single machine cycle. This is achieved as a result of parallel operation of the three main blocks: central control, the arithmetic block and the memory control block.

The central control block is designed to select, unpack and buffer the instructions, to control the operation of the arithmetic block and to perform systems functions. The block has two-level microprogram control and provides combination of performing instructions.

The arithmetic block performs arithmetic and logic operations. The accelerated multiplication block is connected to the arithmetic block as an additional device. Multiplication is accomplished to 12 digits simultaneously and control of the block is flowsheet.

The memory control block provides interaction of the channels and the central control block with the internal storage, conversion of the virtual address to the physical address, buffering of the sections of internal

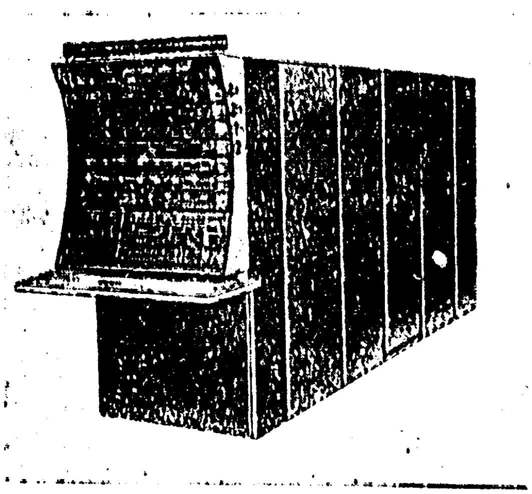

Figure 2. Processor of YeS-1060 Computer

storage most frequently used for access, buffering of information for the channels and correction of a single error of information received from the memory. The block contains a buffer storage, key protection storage and channel buffer storage.

The checking and diagnostics blocks enters and checks the contents of the microprograms in the memory, detects and localizes failures, repeats operations and records events in the system. The block converts the processor to the diagnostics mode.

The operator communicates with the computer by means of the control console, the presence of which permits one to carry out preventive maintenance work, visual checking and control functions.

Microprograms are loaded into the memory from the YeS-5009 magnetic tape console store.

Specifications of YeS-2060 Processor

Control principle	apparatus-microprogram
Digit capacity of arithmetic, bytes	8
Method of representing numbers	with fixed and floating decimal
Counting system	binary, decimal and 16-digit
Time required to fulfill main instructions, microseconds:	

addition-subtraction with fixed decimal	0.32
addition-subtraction with floating decimal	1.8
multiplication with fixed decimal	1.55
multiplication with floating decimal	2.85
division with fixed decimal	5.75
division with floating decimal	4.40
Buffer storage:	
capacity, Kbytes	8
digit capacity, bytes	9
cycles, ns	60
Microprogram storage (main):	
capacity, Kbytes	64
digit capacity, bytes	18
cycle, ns	90
Microprogram control storage:	
capacity, bytes	1,536
digit capacity, bytes	3
cycle, ns	50

YeS-5025 Magnetic Tape Store

The YeS-5025 magnetic tape store (Figure 1) is designed to operate as an external storage device in models of the YeS EVM.

The following are used in the store design: monoroller method of tape feed, block principle of construction, electronics in combination with discrete electronic radio components and light-diode display.

High design-technological compatibility with the baseline YeS-5017 NML is provided in the YeS 5025 store and progressive technical solutions included in the YeS-5017 store are used.

The record-playback channel, based on digital components using integrated circuits, provides recording and playback of data by two methods: phase-coded with longitudinal recording density of 63 bits/mm and by the BVN-1 method (without return to zero with inversion by unity) with longitudinal recording density of 32 bits/mm.

The presence of two methods of recording in the store permits complete use of the data archive recorded by the BVN-1 method and makes it possible to provide gradual rerecording of it on magnetic tape using the more improved phase-coded method of recording.

Semi-automatic loading of the magnetic tape is provided in the store. The magnetic head subassembly is removed during loading and rewinding of the tape. A built-in checking apparatus for self-contained checking of the store efficiency is built into the YeS-5025 store. The store operates with the YeS-5525 control device and is connected to it through a standard interface.

Main Set of YeS-1060 Computer

Name of device	Cipher of device	Number
Processor	YeS-1060	1
Control console	YeS-1501-01	1
Magnetic tape console store	YeS-5009	1
Internal storage (2 Mbytes)	YeS-3206	2
Selector channel (2 channels)	YeS-4035-03	1
Multiplex channel	YeS-4012-01	1
"Channel-channel" adapter	YeS-4060	1
Interchangeable magnetic disk store (NMD)	YeS-5056	10
NMD control device	YeS-5551	2
Magnetic tape store (MNL)	YeS-5017	8
NML control device	YeS-5517	1
Punch card input device	YeS-6019	2
Punch tape input device	YeS-6022	2
Punch card output device	YeS-7010	2
Punch tape output device	YeS-7022	2
Printer	YeS-7032	2
Typewriter with control block	YeS-7077	2
Group control device with four portable consoles	YeS-7906	1
Power supply devices	YeS-0824	1
	YeS-0825	1
Distributing head	YeS-0853	1
Punch card data imprinting and decoding device	YeS-9011	4
Punch card information checking device	YeS-9013	1
Punch tape data preparation device	YeS-9024	1

Specifications

Average access time	100 s
Tape speed	2 m/s
Standard reel rewinding time	not more than 2 minutes
Number of tracks	9
Distance between zones:	
minimum	12.7 mm
nominal	15.2 mm
Tape size:	
maximum length	750 m
width	12.7 mm
Outer diameter of reel	267 mm
Inner diameter of container	296 mm
Power supply	380/220 V
Consumed power	2 kV·A
Overall dimensions	790 x 750 x 1,600 mm

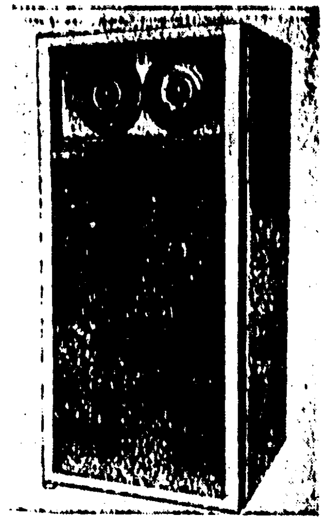

Figure 1. YeS-5025 Magnetic Tape Store

YeS-5525 Magnetic Tape Store Control Device

The YeS-5525 control device is designed to control eight magnetic tape stores of type YeS-5025 and YeS-5017 connected in any combination.

The YeS-5525 device provides interaction of the channel circuits, which have high speed, with low-speed circuits controlling the stores.

The device receives and executes instructions from the channel, transmits data between the store and channel, checks the reliability of data transmitted to and from the store and processes information which describes in detail the state of the device and the condition under which the last operation was completed.

The device permits operation with stores having the following recording methods: without return to zero with inversion by unity (BVN-1) and phase-coded (FK).

The YeS-5525 device can operate with two channels of a single or of different computers and provides an increase of the reliability of read information by automatic correction of single and group errors occurring on a single track with the phase-coded method of recording and also by correction with repeat reading by the BVN-1 method.

The YeS-5525 NML control device has a branched system for checking processed information and for checking the equipment. The electronic part of the device is realized on integrated circuits.

Specifications

Method of connection to channel	standard interface
Cipher and number of connected stores	up to 8 stores of type YeS-5025 and YeS-5017
Maximum data transmission speed:	
for the FK method of recording	126 Kbytes/s
for the BVN-1 method of recording	64 Kbytes/s
Power supply	380/220 V
Consumed power	1 kV·A
Overall dimensions	1,200 x 750 x 1,600 mm

YeS-5066 Interchangeable Magnetic Disk Store

The YeS-5066 interchangeable magnetic disk store (Figure 1) with capacity of 100 Mbytes is a high-speed storage device and is designed for use as an external memory in models of the YeS EVM. The store is connected to the computer through the YeS-5566 control device. Up to eight stores of type YeS-5066 can be connected to one control device.

Structurally the store is made in the form of a pedestal. The store has a telescoping transparent cover for easy access to the disk packet.

The drive and positioning block which includes the carriage block with magnetic heads, the disk packet rotational drive, the carriage block drive with magnetic heads, the record-read block and a brush mechanism for cleaning the surfaces of the disk packet, is located in the upper part of the pedestal. The power supply blocks, positioning drive control block and the automatics and electromechanical system control block are located in the lower part of the pedestal.

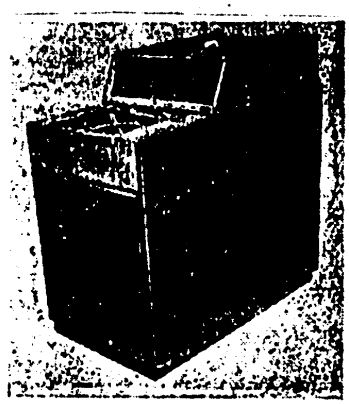

Figure 1. Overall View of YeS-5066 Interchangeable Magnetic Disk Store

he interchangeable disk packet consists of 12 disks and corresponds completely to the requirements of international standards. The disk surfaces have a ferrolacquer coating.

The floating element of the magnetic heads is made of hard ceramic alloy.

The carriage block with magnetic heads is driven by a linear motor which provides the required drive speed. It has a long service life, is resistant to the effects of increased climatic factors and is simple to maintain.

The electronic part of the store is based on integrated circuits and digital components.

Specifications

Capacity of a single interchangeable disk packet	100 Mbytes
Number of working surfaces in a packet	19
Number of surfaces for servo drive control	1
Number of tracks on each surface	411
Method of recording information	three-frequency
Number of heads	20
Time of finding the cylinder:	
minimum	10 ms
maximum	55 ms
average	33 ms
Average time of access to information	not more than 41 ms
Disk rotational speed	3,600 rpm
Data distribution	arbitrary
Data transmission speed	806 Kbytes/s
Time of changing packet	1.5 min
Principle of checking information recording	time selection
Power supply	380/220 V, 50 Hz
Consumed power	not more than 2.5 kV·A
Overall dimensions	1,131 x 671 x 1,135 mm

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ELECTRONICS AND ELECTRICAL ENGINEERING

UDC 621.396.67

CALCULATING THE CHARACTERISTICS OF ANTENNAS IN THE FORM OF LOADED ARRAYS SUSPENDED LOW ABOVE THE EARTH WITH DAMPED PERIODICITY

Unknown RADIOTEKHNIKA in Russian Vol 33 No 9 1978 signed to press 7 Dec 77 pp 57-60

[Article by O. N. Tereshin, A. N. Yuvko and N. B. Borovik]

[Text] The extensive use of wire antennas (the Beveredge antenna, the rhombic antenna and so on, [1] was determined by their structural simplicity and low cost. The disadvantages of a rhombic antenna are significant height of suspension above the earth ($h \geqslant \lambda/4$), which requires rather complex support structures, and their low efficiency. The height of suspending a Beveredge antenna is insignificant (usually hundredths of a wavelength), but the amplification factor is low in this case. Therefore, problems of constructing antennas with low height of suspension above the earth and high efficiency are very urgent. In realizing anteenas suspended low on band lines, they may be used extensively in the UHF range.

The problem of developing a method of calculating antennas in the form of a system of parallel wires with reactive loads periodically connected to them is solved below. An antenna in the form of a system of equidistant wires 1 (Figure 1) to which the reactive loads 2 are connected is taken as the basis in the analysis. The antenna array is suspended at a height of $h \ll \lambda$ above an ideally conducting earth 3.

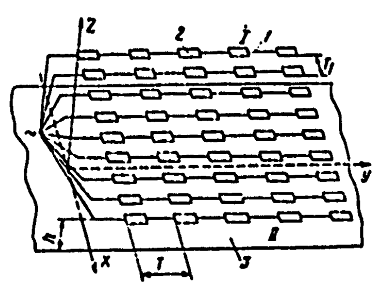

Figure 1

Let us consider the main relations which link the geometry of the system and the value of the loads to the radiation field parameters. Let us assume in analyzing this relationship that the field between the system of wires and an ideally conducting earth (in zone II, $0 < z < h$, Figure 1) is two-dimensional in nature, i.e., the condition $\partial/\partial x = 0$ is fulfilled for all its components. Let us assume that this same hypothesis is valid for the radiation field in an external half-space (zone I, $z > h$).

With regard to the assumptions made, we write the radiation field in the form

$$H_{x1} = A_1 e^{p(z-h)} e^{qy}; \tag{1}$$

$$E_{y1} = -\frac{ip}{\omega\varepsilon_1} A_1 e^{p(z-h)} e^{qy}, \tag{2}$$

$$E_{z1} = \frac{iq}{\omega\varepsilon_1} A_1 e^{p(z-h)} e^{qy}, \tag{3}$$

where A_1 is the amplitude coefficient;

$$p = -n\cos\theta - im\sin\theta; \qquad q = -im\cos\theta + n\sin\theta; \tag{4}$$

m is retardation; $n = \sqrt{m^2 - k_1^2}$; θ is the angle between plane XOY and the direction of the radiation wave propagation; ε_1 is the dielectric permeability of the medium I; and k_1 is the propagation constant in the medium I.

Being given the field in the form of (1)-(3) permits one to obtain a high directional action coefficient with low damping of the surface wave [2]. This is caused by the fact that the wave decreases weakly in a direction perpendicular to the direction of its propagation and provides a high cophasal surface on the end of the antenna. Moreover, because of the smallness of damping of the radiation wave, its energy is totally emitted into free space. The validity of the indicated hypothesis was confirmed by theoretical and experimental checks in a number of investigations, for example, [2, 3].

In zone II, let us be given the field in the form of the sum of two waves: the surface wave:

$$H_{x2} = B\,\mathrm{ch}(pz) e^{qy}; \tag{5}$$

$$E_{y2} = -\frac{ip}{\omega\varepsilon_1} B\,\mathrm{sh}(pz) e^{qy}; \tag{6}$$

$$E_{z2} = \frac{ip}{\omega\varepsilon_2} B \operatorname{ch}(pz) e^{qy} \quad (7)$$

(where ε_2 is the dielectric permeability of the medium II) and of the regular wave of the band line:

$$H_{z3} = C e^{-ik_2 y} \quad (8)$$

$$E_{z3} = \frac{k_2}{\omega\varepsilon_2} C e^{-ik_2 y}, \quad (9)$$

and k_2 is the propagation constant in the medium II.

Let us consider a system of boundary conditions for the model shown in Figure 1. The boundary condition of the following form should be fulfilled on an ideally conducting earth

$$E_y = 0 \text{ at } z = 0. \quad (10)$$

As can be seen from (5)-(9), the field in half-space II satisfies this condition.

Let us write the boundary conditions for z = h. The following boundary conditions should be fulfilled on a system of wires with reactive loads connected to them (at $T_1 \ll \lambda$, $T \ll$ and $h \leqslant T_1/2T\pi$; $h \leqslant T/2\pi$) [4]:

$$E_{y1} = E_{y2} \text{ at } z = h; \quad (11)$$

$$Z_n = \frac{T}{T_1} \frac{E_{y1}}{(H_{z1} - H_{z2} - H_{z3})} \text{ at } z = h, \quad (12)$$

where T and T_1 are the periods of the structure. If one takes (2) and (6) into account, condition (11) assumes the form

$$B = \frac{\varepsilon_2}{\varepsilon_1} \frac{A_1}{\operatorname{sh}(ph)}. \quad (13)$$

By substituting (1), (2), (5) and (8) into (12) with regard to (13), we find

$$Z_n = -\frac{ip}{\omega\varepsilon_1} \frac{T}{T_1} \frac{1}{1 - \frac{\varepsilon_1}{\varepsilon_2} \operatorname{cth}(ph) - \frac{C}{A_1} e^{-ik_2 y - qy}}. \quad (14)$$

To find a high amplification factor of the antenna, it is necessary that the loads be purely reactive, i.e., that the following condition be fulfilled

$$\mathrm{Im}\,\frac{P}{1-\frac{\varepsilon_2}{\varepsilon_1}\,\mathrm{cth}\,(ph)-\frac{C}{A_1}\,e^{-i\kappa_2 y-qy}}=0. \qquad (15)$$

Substituting (4) into (14) with regard to (15) and assuming that

$$m\cos\theta=\kappa_2;\qquad C/A_1=\alpha+i\beta;\qquad \varepsilon_1=\varepsilon_2, \qquad (16)$$

we have

$$Z_n=-\frac{1}{\omega\varepsilon_1}\,\frac{T}{T_1}\,\frac{n^2\cos^2\theta+m^2\sin^2\theta}{\dfrac{m\sin\theta\sin(2hm\sin\theta)-n\cos\theta\,\mathrm{sh}\,(2nh\cos\theta)}{\mathrm{ch}\,(2nh\cos\theta)-\cos(2mh\sin\theta)}+R}, \qquad (17)$$

where

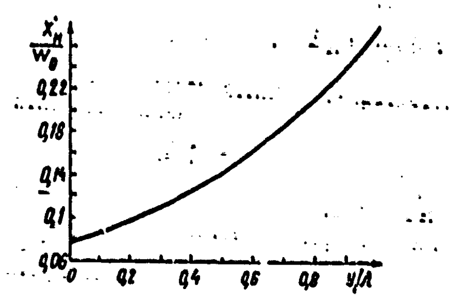

Figure 2

Since construction of a discharge wave antenna circuit assumes purely reactive load resistances, the equation which links the active power fed to half-space II to the active power departing to half-space I should be valid, i.e.,

$$\mathrm{Re}\int_0^h[(E_{z2}+E_{z3})(H^*_{x2}+H^*_{x3})]|_{y=0}\,dz=-\mathrm{Re}\int_0^L E_{y1}H^*_{x1}\,dy\,|_{z=h}. \qquad (18)$$

By substituting (1), (2), (4), (5), (7)-(9) and (16) into (18), we find

$$n\cos\theta + h\kappa_2(\beta m\sin\theta - \alpha n\cos\theta) - h\left(\alpha mn\cos^2\theta + \frac{\beta n^2}{2}\sin 2\theta + \right.$$
$$\left. + \alpha nm\sin^2\theta - \frac{\beta m^2}{2}\sin 2\theta\right) + \kappa_2 h^2(n^2\cos^2\theta + m^2\sin^2\theta)(\alpha^2+\beta^2) = \quad (19)$$
$$= \frac{m(n^2\cos^2\theta + m^2\sin^2\theta)h}{2n}(e^{2n\sin\theta L} - 1),$$

where L is the length of the antenna.

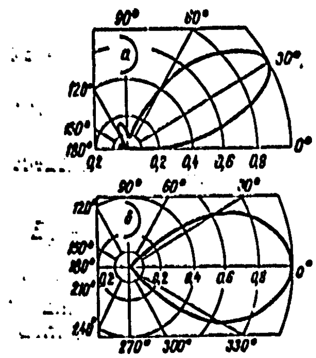

Figure 3

The derived system of formulas permits one to recommend the following order of calculating the antenna:

1. The height of suspension h and the ratio between the amplitudes of the power supply and radiation waves are determined according to formulas (15), (16) and (19) with regard to the parameters of the given antenna radiation pattern and length.

2. The required load distribution function along the y-axis is calculated by formula (17).

The array of wires for parameters: $m = 1.1k_1$; $\theta = 25°$; $h = 0.02\lambda$; $L = 1\lambda$; $T = 0.1\lambda$; and $T_1 = 0.025\lambda$ (40 wires) was calculated by the derived formulas. The law of variation of the values of load resistances is shown in Figure 2.

A mockup of the antenna in the form of a system of wires with reactive loads connected to them (inductionless capacitors) was constructed for an experimental check of the given method of calculation.

The results of the experimental check are presented in Figures 3 and 4: the power radiation pattern in plane E on the calculated frequency is shown in Figure 3, a; the radiation pattern in plane H is shown in Figure 3, b; and the dependence of the antenna input impedance on frequency is shown in Figure 4.

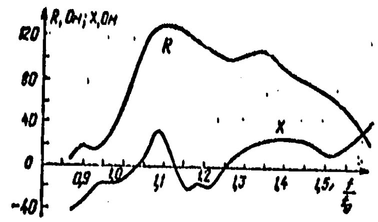

Figure 4

Conclusions. The given method permits one to calculate the electrical and geometric parameters of a system of wires suspended low above the earth with reactive loads connected to them by the given characteristics of the radiation field.

The experimental check confirmed the correctness of the hypotheses made.

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GEOPHYSICS, ASTRONOMY AND SPACE

UDC 532.593

PLANE INTERNAL WAVES ARISING IN A STRATIFIED FLUID DURING FLOW AROUND A SOURCE-DISCHARGE SYSTEM

Kiev GIDROMEKHANIKA in Russian No 36 1977 signed to press 12 Feb 76 pp 66-70

[Article by V. I. Nikishov and A. G. Stetsenko, Institute of Hydromechanics of the Ukrainian SSR Academy of Sciences]

[Text] The plane problem of wave motions arising in an ideal stratified fluid during uniform flow around a source and discharge of equal capacity is investigated in linear postulation. It is assumed that the fluid is bounded on the top and bottom by solid walls and that the flow rate U coincides with the positive direction of axis Ox. Axis Oy is directed vertically upward with the origin on the upper boundary. The source and discharge are located at distance h from the upper boundary and the segment connecting them (with value 2a) is parallel to axis Ox; axis Oy passes through its middle (Figure 1).

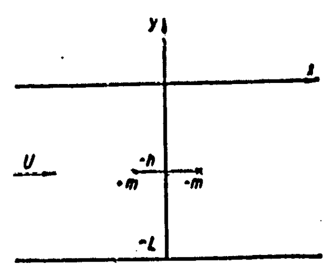

Figure 1. Location of Source and Discharge in Flow

It is shown in [4] that, although similar problems are stationary, they may be solved as nonstationary. Subsequent conversion to a stationary problem can be made by using the maximum conversion at $t \to \infty$. The last statement, as in [2], is made from physical concepts. Thus, it is assumed in the investigation that the output of the source (discharge) is dependent on time in the form of a single Heaviside function H(t).

Let us assume the undisturbed value of density is in the form

$$\rho_0(y) = \rho_{00}e^{-\sigma y}, \tag{1}$$

where ρ_{00} is the value of density near the upper boundary.

The linearized equations of motion have the form [2, 4]

$$\frac{\partial u}{\partial x} + \frac{\partial v}{\partial y} = mH(t)\,\delta(y+h)\,[\delta(x+a) - \delta(x-a)] \tag{2}$$

$$\frac{\partial \rho}{\partial t} + U\frac{\partial \rho}{\partial x} + v\frac{d\rho_0(y)}{dy} = 0, \tag{3}$$

$$\rho_0(y)\left(\frac{\partial u}{\partial t} + U\frac{\partial u}{\partial x}\right) + \frac{\partial p}{\partial x} = 0, \tag{4}$$

$$\rho_0(y)\left(\frac{\partial v}{\partial t} + U\frac{\partial v}{\partial x}\right) + \frac{\partial p}{\partial y} = -\rho g, \tag{5}$$

where u and v are the horizontal and vertical velocity components; ρ is the instantaneous difference between the total density and ρ_0(6); p is the instantaneous difference between the total and hydrostatic pressure; m is the output of the source (discharge); and δ is a Dirac delta-function.

By introducing operator $D \equiv \partial/\partial t + U(\partial/\partial x)$ and the typical scales of length L (the distance between the boundaries), velocity U and density ρ_{00}, we find the equation for the vertical velocity component v in dimensionless variables:

$$D^2\left(\frac{\partial^2 v}{\partial x^2} + \frac{\partial^2 v}{\partial y^2}\right) + \lambda\sigma\frac{\partial^2 v}{\partial x^2} - \sigma D^2\frac{\partial v}{\partial y} = \\ = D^2\{QH(t)[\delta(x+a) - \delta(x-a)][\delta'(y+h) - \sigma\delta(y+h)]\}, \tag{6}$$

where $\lambda = gL/U^2$ and $Q = m/UL$.

Applying the Laplace transform by t and the Fourier transform by x to (6)

$$\tilde{v}(k, y, s) = \int_0^\infty e^{-st}dt \int_{-\infty}^{\infty} e^{-ikx}v(x, y, t)\,dx, \tag{7}$$

we find the following equation for function $\tilde{v}(k, y, s)$ (we shall subsequently omit the symbol $\sim$)

$$\frac{d^2v}{dy^2} - \sigma\frac{dv}{dy} - (k^2 - \lambda_1\sigma)v = \frac{2iQ}{s}\sin ka\,[\delta'(y+h) - \sigma\delta(y+h)], \tag{8}$$

where $\lambda_1 = \lambda k^2/(s + ik)^2$.

The boundary conditions are:

$$v = 0 \text{ at } y = 0 \text{ и } y = -1. \tag{9}$$

For convenience let us introduce function G such that

$$v = Q\left(\frac{\partial}{\partial h} - \sigma\right)G. \tag{10}$$

Then from (8), for the value of G, we find the equation

$$\frac{d^2G}{dy^2} - \sigma\frac{dG}{dy} - (k^2 - \lambda_1\sigma)G = \frac{2i}{s}\sin ka\,\delta(y+h) \tag{11}$$

with boundary conditions

$$G = 0 \text{ at } y = 0 \text{ и } y = -1. \tag{12}$$

Solution of equation (11) with boundary conditions (12) has the form

$$G(y) = \frac{2i}{s}\sin ka\,\frac{e^{\frac{\sigma}{2}(y+h)}}{M\,\mathrm{sh}\,M}\,\mathrm{sh}\left(M\frac{2+y-h-|y+h|}{2}\,\mathrm{sh}\left(M\frac{y-h+|y+h|}{2}\right)\right), \tag{13}$$

where

$$M = \sqrt{\frac{\sigma^2}{4} + k^2 - \lambda_1\sigma}.$$

Knowing function G, from (10) one can find the expression for the deviation of the isopycnic lines from the position of equilibrium $\xi(k, y, s)$, which is determined from the equation

$$D\xi = v. \tag{14}$$

Thus, from (10) and (14) we find

$$\xi(k, y, s) = \frac{iQ \sin ka}{s(s + ik)} \frac{e^{\frac{\sigma}{2}(y+h)}}{M \operatorname{sh} M} \{M \operatorname{sign}(y + h) \operatorname{sh} M(1 - |y + h|) - \\ - M \operatorname{sh} M(1 + y - h) - \sigma \operatorname{sh} M \frac{2 + y - h - |y + h|}{2} \operatorname{sh} M \frac{y - h + |y + h|}{2}\}. \quad (15)$$

In the complex domain k, function ξ has characteristic features in the form of poles which are determined from the equation

$$M = in\pi \quad (16)$$

or

$$\frac{\sigma^2}{4} + k^2 - \lambda_1 \sigma = -n^2\pi^2, \quad (16a)$$

where n = ±1, ±2, ±3, ...

For convenience let us introduce $\omega_n^2 = -\gamma_n^2 = \varkappa^2 - n^2\pi^2 - \sigma^2/4$, where $\varkappa^2 = \lambda\sigma$, and let us consider two cases.

1. $\omega^2 < 0$. In this case all poles are purely imaginary and are represented in the form

$$k = \pm i\gamma_n - is\frac{\varkappa^2}{\gamma_n^2}. \quad (17)$$

2. $\omega_n^2 > 0$. For small positive values of s, the poles are described by the expression

$$k = \pm\omega_n + i\frac{\varkappa^2}{\omega_n^2}s + 0(s^2). \quad (18)$$

By using the inverse Fourier transform and the limiting theorem for the Laplace transform, we find

$$\xi(x, y) = \frac{1}{2\pi}\int_{-\infty}^{\infty} e^{ikx} \lim_{s \to +0} s\xi(x, y, s)\, dk. \quad (19)$$

Let $\omega_n^2 > 0$ at n = N and $\omega_n^2 < 0$ at n = N + 1. There will then be N poles on the real axis and bypass of them is selected with regard to expression (18) (Figure 2). Making use of the Cauchy theorem and the Jordan lemma, we find the following for x > a:

$$\xi(x, y) = -\sum_{n=1}^{N} 2A_n \frac{\sin \omega_n a}{\omega_n^2} \sin \omega_n x + \sum_{n=N+1}^{\infty} A_n e^{-\gamma_n x} \frac{\operatorname{sh} \gamma_n a}{\gamma_n^2}, \tag{20}$$

where

$$A_n = Qe^{-\frac{\sigma}{2}(y+h)}(-1)^n [n\pi \sin n\pi (1 + y - h) - n\pi \operatorname{sign}(y + h) \times$$
$$\times \sin n\pi (1 - |y + h|) + \sigma \sin n\pi \frac{2 + y - h - |y + h|}{2} \sin n\pi \frac{y - h + |y + h|}{2}.$$

Undamped wave motion, which is determined by the real poles of the subintegral function, does not occur if $\omega_n^2 < 0$ or

$$U > U_1 = \sqrt{\frac{\sigma g L}{\pi^2 + \frac{\sigma^2}{4}}}. \tag{21}$$

If $U_{N+1} < U < U_N$, where $U_n = \sqrt{\frac{\sigma g L}{n^2\pi^2 + \frac{\sigma^2}{4}}}$, undamped wave motion is formed from N waves.

This result is found according to [3].

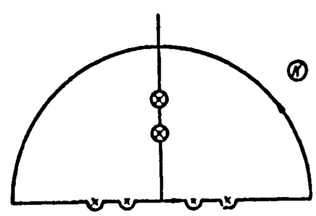

Figure 2. Integration Contour in Complex Plane K

The pattern of motion described above may be explained in the following manner. The system -- a stratified medium located between solid boundaries -- has a set of natural oscillations. When disturbances with high velocity ($U > U_1$) pass through this medium, the system is unable to become excited; if the velocity of motion of the disturbances is sufficiently small ($U < U_1$), the system is excited and we obtain undamped wave motion as a result.

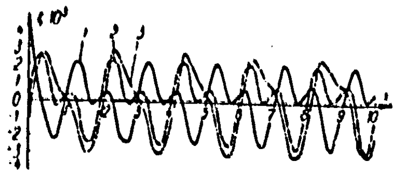

Figure 3. Dependence of Oscillation Amplitude on x at Fixed Distance Between Characteristics (α = 0.046455): 1 -- y = -0.6; 2 -- y = -0.4; 3 -- y = -0.2

The second sum in (2) describes the local effects in the vicinity of the characteristics which are determined by the imaginary poles and which are rapidly damped with an increase of x.

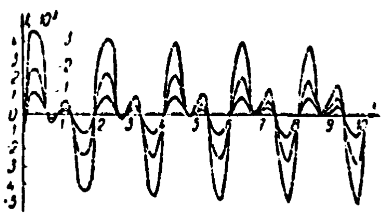

Figure 4. Dependence of Oscillation Amplitude on x at Different Distances Between Characteristics: 1 -- y = 0.4, α = 0.01562; 2 -- y = -0.4, α = 0.046455; 3 -- y = = -0.4, α = 0.096651

It is known that unlimited flow of a uniform fluid around a source-discharge system is equivalent to flow around an oval. Let us assume, as in [2], that this is also valid in the given case.

Being given the half-width of body R, elongation d and incident flow velocity U, the values of m and a can be found by the formulas given in [1].

Concrete calculations were carried out with the following values of the parameters: h = 0.7, y = -0.2, -0.4, -0.5 and -0.6; α = 0.0156, 0.0465 and 0.0966 (which corresponds to d = 2, 5 and 10); σ = 0.25; and λ = 196. The derived functions of $\xi = \xi(x)$ are presented in Figures 3, 4 and 5.

It is obvious from the figures that the wave pattern varies asymmetrically along Ox. This is more clearly expressed in Figure 4. It is obvious from this same figure that the value of ξ, as in [3], is strongly dependent on the value of α: the oscillation amplitude increases as elongation increases.

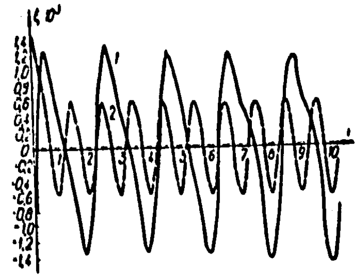

Figure 5. Dependence of Oscillation Amplitude on x at y = -0.2 (1), y = -0.5 (2) and α = 0.01562

A decrease of oscillation amplitude at y = -0.5 (see Figure 5) is explained by the fact that all modes with even values of n disappear since they all pass through zero at y = -0.5.

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SCIENTISTS AND SCIENTIFIC ORGANIZATIONS

UDC 55(092)

NIKOLAY ANDREYEVICH BELYAYEVSKIY

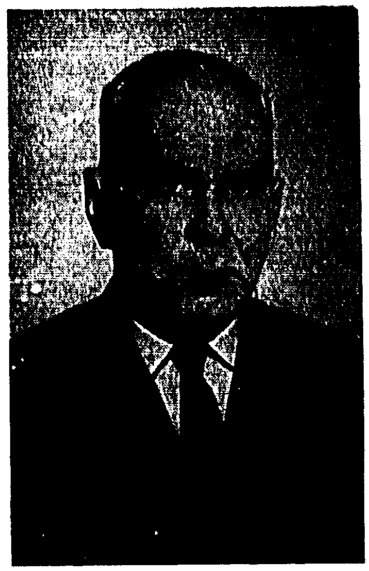
Moscow SOVETSKAYA GEOLOGIYA in Russian No 10, 1978 pp 154-155

[Article by Ye. A. Kozlovskiy, B. M. Zubarev, V. I. Igrevskiy, A. A. Ryasnoy, A. D. Shcheglov, Yu. G. Erv'ye, V. A. Yarmolyuk, N. A. Udodov, N. P. Laverov, V. Yu. Zaychenko, A. I. Zhamoyda, Ye. A. Kozlov, L. I. Krasnyy and A. P. Markovskiy on the death of Nikolay Andreyevich Belyayevskiy]

[Text] Soviet geological sciences has suffered a severe loss. Nikolay Andreyevich Belyayevskiy -- well-known Soviet geologist, laboratory head of the All-Union Scientific Research Institute of Geophysical Methods of Prospecting, member of the CPSU, Doctor of Geological-Mineralogical Sciences, Professor, Meritorious Scientist and Technician of the RSFSR and member of the Editorial Board of the Journal SOVETSKAYA GEOLOGIYA -- died unexpectedly in his 65th year.

N. A. Belyayevskiy (jointly with P. A. Gryushe) wrote his first official report on the geological structure and minerals of the Kungey-Alatau Ridge in 1934 -- the year he completed the Leningrad Mining Institute, and his first article on the alpine tectonics of the Kuen'-Lun' was printed in 1945. Since then N. A. Belyayevskiy has published more than 200 scientific papers, including a number of monographs devoted to problems of regional geology and metallogeny, geological cartography, stratigraphy and lithology, geomorphology and paleoclimatology, tectonics and geophysics. Nikolay Andreyevich has made a weighty contribution to each of these branches of geology, but his main interests, especially during the past 15 years, were related to tectonics in its broadest understanding.

During the 1930's and the first half of the 1940's, N. A. Belyayevskiy worked at TsNIGRI-VSEGEI [Central Scientific Research Institute for Geological Exploration -- All-Union Scientific Research Institute of Geology]. He was a member of the expedition and investigated the weakly studied and difficultly accessible regions of the Southern and Eastern Tyan'-Shan', the Karakorum, Kun'-Lun', the Tarimskaya Basin and the edge of Tibet. His doctoral dissertation, which he brilliantly defended in 1952, was devoted to the geological structure and minerals of Central Asia.



N. A. Belyayevskiy conducted intensive investigations in the Sikhote-Alina and in the Southern Primor'ye, heading a group of geological survey and exploratory parties, since 1946 for more than 10 years. Analysis of the enormous new materials permitted him jointly with his colleagues to work out an essentially new scheme of stratigraphy and to again illuminate the history of the geological development of the region, which predetermined the basis of the geostructural regionalization and metallogenic specialization of the determined structural-facies zones (1953). Based on the data obtained, a geological map and a map of the minerals of the Primor'ye were also compiled and a monograph was written (1955) which largely determined the development of further geological and metallogenic investigations in the Far East.

During the period 1950-1956 N. A. Belyayevskiy headed the Scientific Production Department of VSEGEI, working in the field of regional geology, minerals and geological cartography.

In 1956 N. A. Belyayevskiy was appointed Deputy Minister of Geology and Conservation of Resources of the USSR. After the ministry was transformed to the State Geological Committee of the USSR, he was confirmed as a member of the Collegium of the Committee and chief of the department of geological mapping and later as chief of the department of scientific research work. In these responsible positions, N. A. Belyayevskiy skillfully directed the activity of subordinate scientific research institutes, familiarized himself in detail with the achievements of foreign geological services and the status of mineral raw material resources of different countries and participated actively in the work of sessions of the International Geological Congress and other international organizations. He published official reports on the foreign tours of detached duty without delay; his positive experience was introduced in the institutions of geological service of our country.

N. A. Belyayevskiy together with I. I. Gorskiy was one of the organizers of the International Union of Geological Sciences and he was first vice-president (from the USSR) of the Commission on the Geological Map of the World. The first draft of the legend to the geological map of the world belongs to him (1958). N. A. Belyayevskiy's extensive experience and vast knowledge in the field of geological surveying and cartography predetermined his indispensable participation in compilation of manuals and instructions and also in the activity of the editorial boards of various geological maps of the Soviet Union.

Nikolay Andreyevich's investigations in the field of tectonics always had a clear practical direction and were characterized by extensive and universal generalizations. He always posed as the purpose of his investigations determination of the principles of the location of minerals as a function of tectonic criteria.

Determining the relationship of the geological structure to the deep structures of the earth's crust was the next step of the scientist on the path to development of complex geological-geophysical investigations. As early as 1961, he and V. V. Fedynskiy published an article entitled "Study of the Earth's Deep Interior and the Problems of Superdeep Drilling" in the journal SOVETSKAYA GEOLOGIYA. Therefore, it is no accident that N. A. Belyayevskiy has headed investigations at VNIIgeofizika [All-Union Scientific Research Institute of Geophysical Exploration Methods] since 1965 on the study of the deep structure of the earth's crust and upper mantle and on creation of geological-geophysical maps of the USSR. The range of his interests included seismic sounding, island arcs and rift zones, the earth's thermics, applied geophysics, explosion seismology and so on.

The result of these multifaceted investigations was the large monograph "The Earth's Crust Within the USSR" (1974), which is the reference book of specialists engaged in problems of regional tectonics and geophysics. Fundamental geophysical problems, primarily the essence of seismic boundaries, are considered in it from geological positions based on extensive factual material.

N. A. Belyayevskiy was one of the innovators and managers of work to develop "Maps of the Faults of the USSR and Adjacent Countries." His personal contribution to his innovative work was especially great in solving complex problems on reconstruction of faults and other structures of the platform foundation and in methodical developments on the use of geological-geophysical data for these purposes.

One cannot help but note the editorial and scientific-organizational activity of N. A. Belyayevskiy. He was a member of the editorial boards of the fundamental publications GEOLOGIYA SSSR and GEOLOGICHESKAYA IZUCHENNOST' SSSR and the editor of many maps and a number of monographs, including translated monographs. From 1956 through 1965 N. A. Belyayevskiy was the editor-in-chief of the journal SOVETSKAYA GEOLOGIYA and was an active member of the editorial board during the past few years. He was also the deputy chairman of the Scientific Council on Complex Investigations of the Earth's Crust and Upper Mantle of the USSR Academy of Sciences, a member of the bureau of the Committee on the International Geodynamic Project and the Interagency Tectonic Committee and a member of scientific councils of VNIIgeofizika and the Department of Geology of Moscow State University.

Nikolay Andreyevich devoted a great deal of attention to training highly qualified cadres -- many of his students became candidates and doctors of sciences. He headed the expert commission of VAK [High Degree Commission] for a number of years.

N. A. Belyayevskiy's labor activity has been noted by government awards -- the Order of the Red Banner of Labor and medals.

All who knew Nikolay Andreyevich and who worked with him were inspired by his unflagging energy, deep erudition, enormous efficiency and purposefulness.

The bright image of N. A. Belyayevskiy -- a highly cultured person, talented scientist-communist, devoted without limit to his motherland, strict in his analyses but a kind person -- will always be retained in our memory.

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SCIENTISTS AND SCIENTIFIC ORGANIZATIONS

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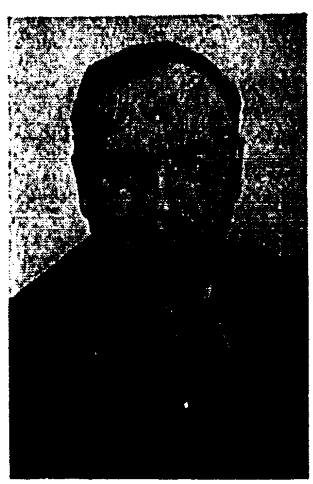
YEVGENIY VILLIAMOVICH KARUS

Moscow SOVETSKAYA GEOLOGIYA in Russian No 10, 1978 p 109

[Article by Ye. A. Kozlovskiy, B. M. Zubarev, I. D. Vorona, V. I. Igrevskiy, A. A. Ryasnoy, A. D. Shcheglov, Yu. G. Erv'ye, V. A. Yarmolyuk, V. Yu. Zaychenko, N. F. Karpov, N. P. Laverov, V. V. Semenovich, V. A. Pervago, V. A. Chernov, V. V. Nortikoyev, L. M. Zor'kin and L. G. Petrosyan commemorating Ye. V. Karus's 60th birthday]

[Text] The director of the All-Union Scientific Institute of Nuclear Geophysics and Geochemistry (VNIIYaGG), Doctor of Physicomathematical Sciences, Professor Yevegniy Villiamovich Karus is celebrating his 60th birthday.



Ye. V. Karus is a well-known scientist in the field of exploratory geophysics -- seismology and geoacoustics. The results of his scientific activity are widely known both in the USSR and abroad. He began his scientific research work in 1939 at the Institute of Theoretical Geophysics (now the Institute of Physics of the Earth imeni O. Yu. Shmidt), where he worked for more than 30 years.

During the period 1939-1946 Ye. V. Karus participated in development of the correlation method of refracted waves, first created in the USSR under the supervision of G. A. Gamburtsev and which has now become one of the main methods of seismic prospecting. During World War II he participated actively in exploratory-prospecting work for oil and gas in the regions of the Tatarskaya and Bashkirskaya ASSR.

During the period 1957-1964 Ye. V. Karus supervised and directly participated in development of the method and interpretation of seismic prospecting observations during study of the underice relief and thickness of the Antarctic ice cover. He is editor of four maps which have become part of the Atlas of the Antarctic.

Ye. V. Karus's investigations on the use of high-frequency elastic vibrations to solve geological prospecting problems are widely known. Development of a new method of geophysical research based on the use of steady harmonic vibrations (80-6,000 vibrations per second) was begun in 1974 under Ye. V. Karus's supervision. This method opened new opportunities to study the physical properties of rock under natural conditions to solve a number of problems of the propagation of elastic vibrations (dispersion and absorption of elastic waves in rock).

Ye. V. Karus managed to demonstrate the possibilities of using the method of steady harmonic vibrations in mining geology. This method has now found rather wide practical application.

A method of geoacoustic investigations of deep boreholes (ultrasonic logging -- UZK) was developed under the supervision and with the direct participation of Ye. V. Karus and he improved the method and technique of observations and methods of interpreting the data obtained. Ye. V. Karus's development of the fundamentals of the theory of this method made it possible to develop various modifications of UZK.

Ye. V. Karus has headed VNIIYaGG since 1969. The complex of nucleophysical and geoacoustic methods of investigating boreholes with respect to exploration and calculation of oil and gas reserves and also solid minerals is being developed here under his supervision.

Ye. V. Karus has carried on extensive pedagogical work over many years in educating scientific cadres of higher qualification and the scientific school of geophysicists was formed under his supervision.

Warmly congratulating him on this anniversary date, we wish Yevgeniy Villiamovich good health and new creative successes.

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SCIENTISTS AND SCIENTIFIC ORGANIZATIONS

SERGEY GLEBOVICH MALININ (1920-1978)

Moscow NAUCHNO-TEKHNICHESKAYA INFORMATSIYA, SERIYA 1 -- ORGANIZATSIYA I METODIKA INFORMATSIONNOY RABOTY in Russian No 9, 1978, p 29

[Text] Sergey Glebovich Malinin, candidate of technical sciences, chairman of the Scientific and Technical Council of the Automated International System of Scientific and Technical Information on Electronics of CEMA Member-Countries, assistant to the chief designer of information systems in the country, deputy director of VNII Informelektro [All-Union Scientific Research Institute of the Center of Scientific and Technical Information on Power Engineering and Electrification] died suddenly on 18 September 1978.

S. G. Malinin's life and activities are a striking illustration of the history of the conception, interpretation, and realization of the information industry in our country. Being one of the outstanding pioneers of information science, he greatly influenced information science in our country both as an author of numerous original scientific works and as a director of one of the country's best known teams of information workers.

His ideas in the area of integration of information and information control systems gave rise to the following definition of the concept of control, a concept deep in essence and brilliant in form:

"Control is: information and prediction,
information and planning,
information and solution,
information and control."

The principles developed by him in the area of designing sectoral and polythematic information systems were responsible for the creation of information systems in electrical engineering; brought into existence the international automated information system in electrical engineering; and will influence for many years the development of information theory and practice in our country and abroad.

S. G. Malinin's work style was characterized by indissoluble unity of theory and practice, academic and organizational boldness, strategical purposefulness, and tactical flexibility in achieving his goals. These qualities in combination with brilliant scholarly intuition and organizational talent made it possible for him to become an originator and active participant of many important projects and studies connected with the improvement of the system of scientific and technical information in the country.

S. G. Malinin developed the principle of combining the development of organizational-functional structure of sectoral information system in electrical engineering with simultaneous realization of automated information processes within the framework of industrial technology.

The country's first industrial automated document retrieval system was created under the direction of S. G. Malinin. It was also the world's first industrial-type system with automatic indexing of input documents. The Informelektro Institute, which for more than 20 years was headed by S. G. Malinin, was a pioneer in the development of data retrieval systems. This institute directed by S. G. Malinin developed and introduced microcards with descriptions of inventions.

S. G. Malinin attached great importance to the dissemination of information. He was the initiator and the author of the first, and so far, the country's only automated system of addressed dissemination of information materials. It is difficult to enumerate all aspects of the organizational and scholarly activity of S. G. Malinin--it is extremely broad and versatile. There are more than 60 works in the area of information science to his credit.

S. G. Malinin founded and was the first editor of the country's only theoretical journal "Scientific and Technical Information" which became indispensible for tens of thousands of specialists in our country and abroad.

Having gone through 20 years of its development, the system of information in electrical engineering directed by S. G. Malinin is now competing successfully with well-known world information systems, and the VNII Informelektro created by him was called an information center of world significance in UNO documents.

It is still too early to summarize the lifetime achievements of S. G. Malinin--he left great problems and directions for their solution for us.

Whoever met S. G. Malinin will always remember his striking, complex and unique image. He was a true communist, a tireless worker, and a man who shared his knowledge generously with people.

His human charm, simple manners, softness, and tolerance of human weaknesses in combination with the highest degree of exactingness with respect to the most important won the love and respect of many thousands of people.

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