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4 January 1980

USSR Report

CYBERNETICS, COMPUTERS AND AUTOMATION TECHNOLOGY

(FOUO 1/80)

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JPRS L/8840

4 January 1980

USSR REPORT

CYBERNETICS, COMPUTERS AND AUTOMATION TECHNOLOGY

(FOUO 1/80)

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I. DEVELOPMENT AND PRODUCTION OF COMPUTERS AND CONTROL EQUIPMENT

A. General Treatment

PROGRESS IN CYBERNETICS

Moscow DRUZHBA NARODOV in Russian No 5, 1979 pp 180-188

[Article by V. Glushkov, academician, vice president of the UkrSSR Academy of Sciences, Director of the Institute of Cybernetics of the UkrSSR Academy of Sciences]

[Excerpts] The collective of the Institute of Cybernetics of the UkrSSR Academy of Sciences strives to follow the best traditions and experience accumulated by Ukrainian science during the years of Soviet power. Our relatively young branch of science, cybernetics, could hardly have arisen at all on the Ukrainian earth without using as a base the enormous progress of science and culture that was provided by the social development of the entire Soviet society during six five-year plans.

In developing cybernetics, we start from two leading principles. The first of them is unity of theory and practice. What does that mean? In a few words, we strive not to develop theory for its own sake. Such a thing is permissible, shall we say, in mathematics, an old science where the foundation was constructed long ago and scientists labor "in the upper floors." and where there is conviction that the foundation of the science is firmly connected with the ground, so that floors which have not yet found practical application will prove useful sooner or later. But if a science like cybernetics is young and is being erected on a bare place, the danger appears of cultivating "bubbles," sterile flowers, of setting out on a false path to "nowhere" with a complete semblance of scientific work.

Therefore we in the Institute of Cybernetics have always striven to organize theoretical investigations by starting from practical questions that have arisen in life itself. But practical questions can also be solved in different ways: here industry presented you with one problem--you solved it, a second problem, again you solved it. And you also investigated something else there. We rejected such an approach. We have striven to have theoretical investigations embrace not one or two but 200 to 300 problems of today and tomorrow all at once. And perhaps that is the most complex--the ability to predict tomorrow's needs on the scale of the sector, the republic and the country.

We have also firmly decided not to start applied research that can be completed without the development of profound theory. That is not the business of the academy. It is all the same that nails are overlooked by the microscope. We will take on a practical theme when we clearly see a great prospect of development and understand that no one besides us will do it. That is what is meant by unity of theory and practice.

Our second fundamental principle is unity of distant and near goals. We will not be afraid to designate long-range goals that will not be achieved before the 21st century. Thus from the very foundation of the institute the task of creating an artificial intellect was set for it. It is quite obvious that the task will not be solved as by an attack of the cavalry. It will not be solved at all by the efforts of a single institute, but only by general efforts--of all Soviet science (even of world science). What conclusions can be drawn from this? They can be different. It would be possible to bury ourselves in the laboratory and tell you not to disturb us, that we will present you with the result of our activity--an artificial intellect--after 30 years. Or 40 years. But we have acted differently. We have so constructed the program of attainment of that goal, the creation of an artificial intellect, that it will already give, in certain stages, a practical yield today, tomorrow and the day after tomorrow.

An example is work on increasing the intellect of machines. We were the first in the world to propose that idea and accomplish it. Many said then that no one needed that, but time has shown that we were right. All world computer technology now proceeds in the same direction. But our machines of the "Mir" class were the pioneers. We increased the intellect of the machine at its birth. Whereas earlier a new machine had only to add, multiply, divide and compare, and from those bricks was then formed its ability to perform complex operations, the "Mir" machine at its birth already "knew" what an integral, an infinite sum, etc, is. Built into it are elements of pure mathematics, and this made it possibly to program far more rapidly and better. Our machines have widely entered the national economy. They continue even today to be produced in new modifications, although you do not surprise anyone with them.

Precisely the same also was the development of the statewide automated system for production management, which we proposed in 1962. A final result of it must be a revolution in the organization of management, a complete transition to a paperless technology of production management. The elimination of reports and other documentation and the transmission of all data to a machine are compared by some scientists with the invention of writing and book printing. The problem is in fact a tremendous one. In my opinion, in its volume and complexity it is comparable with the task of mastering space. And the gain promises to be colossal.

Let us recall that the application of automated management systems (ASU) at individual enterprises increases the efficiency of production by 10-15 percent, and of an association or sector by 50-60, and on scales of the entire country by at least 100 percent, that is, it is doubled, and without additional expenditures on resources.

This problem is a real one, although it can be finally solved only somewhere around the turn of the century. But again we have compiled such a program that its attainment has already given results today.

The entire science of the Ukraine in general, and all the more so ours, cybernetics, is being developed, not as something isolated, but as a component part of all-union science. Besides systems for the management of Ukrainian ministries (Ukrsel'khoztekhnika, the Ukrainian Gosplan, etc), we are taking part in the creation of ASU for the union ministries, mainly with a machine-building and instrument-making profile. Our institute also participates in automation on the level of the USSR Gosplan. Here we have made a dialog system of planning (incidentally, this is one of the works for which the Institute of Cybernetics of the UkrSSR Academy of Science received in 1978 the Challenge Red banner of the CC CPSU, the USSR Council of Ministers, the VTSSPS (All-Union Control Council of Trade Unions) and the CC Komsomol).

We have also made a system of automation that accelerates by hundreds of times tests of complex objects such as aircraft. The TU-144 was tested with its help. Systems have been created for the automation of planning and design work in electronics, machine building and construction. In construction, in planning, not only are calculations automated, but everything including the making of drawings is done by an automatic machine (and also on the basis of dialog with the designer, but without any sort of design office). Such a system has permitted us in Kiev to plan prefabricated reinforced-concrete structures in one-twentieth the time and at one-sixth or one-seventh the cost and has practically eliminated the frequent errors that occurred earlier in the plan documentation. The planning system works, but in the trust they are not yet ready to accept paperless information. Lack of coordination! The world's first draft of paperless technology belongs to us, but we still lag in implementing that matter.

Ten or twenty years ago I expressed such an idea in print (permit me to quote): "Approximate calculations show that if the existing level of quality of planning is preserved (and that level still does not meet the requirements of the present day), and if the level of technological equipping of the sphere of planning, administration and accounting is preserved unchanged, all the adult population of the Soviet Union would have to be employed in that sphere by 1980."

The year 1980 is not far off, and it can be said that my melancholy prediction has proven to be correct. Although the course toward automation designated by the decisions of the 24th CPSU Congress also halted the vast inflation of the numbers of administrative cadres, it must be honestly acknowledged that the rates of introduction of automation into the management of production and its quality do not meet the requirements of the day.

There is even a relative worsening of the quality of management, especially of planning, since the economy has become much more complex.

"Now the task consists in raising all our planning work, the very content of planning, to a qualitatively new level, in more thoroughly comprehending the economic problems that life generates, and conducting a creative search with full responsibility and initiative for the optimum ways to solve them," says the resolution of the CC CPSU entitled, "On the 50th anniversary of the First Five-Year Plan for the development of the national economy of the USSR." Those words seem to be addressed directly to us.

It would be wrong to assume that it is possible to radically improve management by means only of electronic computers, ignoring the economics and measures improving the organization of production. However, it is my deep conviction that neither economic nor organizational regulation of production will achieve success today unless the latest technology is used. It simply cannot be completely realized. In my view, improvement of the management mechanism should be done with technology, that is, with consideration of all the completely new possibilities which it presents today, to economists in particular. A very simple example. In our country there exists, I would say, a global system of bonuses: the plant receives a bonus--everyone receives a bonus. The new technology will help to precisely measure the contribution of the individual worker. A suitable system of stimulation will be required, of course, and the machine will calculate it so that the bonus corresponds to the actual contribution of each person to production.

This is why I would like today to once more draw attention to a task of enormous general state importance--the need to automate the accounting, planning and management of the economics of production. The introduction of the electronic computer in that sphere consists not in a simple replacement of manual labor for calculations of various kinds, but in a transition to optimum planning and management, in a radical change of the technology of organizational administration, of the very methods of administrative labor.

In speaking of the penetration of cybernetics into other sciences, not just economics, we have in mind above all the universal application of electronic computers as a working instrument. But it is not without reason the cybernetics is translated from the Greek as the "art of controlling," the word for "pilot" is closely related to it. Today we define it as the science of the general laws of the obtaining, storage, tansmission and transformation of information in complex management systems--technical, biological, administrative and social. And if one looks more deeply into the role and place of cybernetics in science one can readily be convinced that it introduces truly revolutionary changes especially in the procedure of scientific research in practically all areas of knowledge.

We know the classical deductive method used, for example, in mathematics, with which by means of a formula of transformation and proof a scientist derives new properties of matter, discovers a new planet or new elementary particles. Also known is the experimental method of investigation: the scientists sets up an experiment or observes an experiment in nature, for example, how many rabbits wolves eat in a year, etc.

Our science has created the method of cybernetic experiment in an electronic computer. Far from every experiment can be set up in nature. Let us assume that it was necessary to explain what would happen if the wolves ate all the rabbits. An experiment of that kind, if it were carried out, would unjustifiably disrupt the ecological equilibrium on the planet. Cybernetics, and only cybernetics, permits playing out such a variant in a machine without having a mathematical description of the phenomena. That is, the theory of the phenomenon still has not been derived, there is only an experimental description of the phenomenon with which we conduct experiments--in the memory of the machine, rapidly and without risk of exterminating the entire genus of rabbits on earth.

If we want to model evolutionary processes in nature or surgical intervention in the human brain, if we propose to test a system of social measures for an entire country, cybernetics is irreplaceable. Its method, which approaches the methods of the exact sciences, is applicable to an equal degree to any science, including sociology, history, ecology, descriptive biology, etc, that is, to non-mathematicized sciences. Here is something new in principle that cybernetics contributes to science as a whole.

The panorama of Ukrainian science today is broad and multifaceted. The central place in it is occupied by the Order of Lenin and Order of Friendship of Peoples Ukrainian SSR Academy of Sciences, the creation of which 60 years ago converted into a fact the dream of the progressive Ukrainian intelligentsiya of its own national scientific center. It must be noted that in Russia before the revolution the very concept of "academy of sciences" had a different meaning than now. And science was altogether different. The Academy of Sciences was rather an aggregate of scientists than of scientific institutions, a kind of club where scientists gathered. Such was the Russian Academy of Sciences, and on that principle, as far as I know, were constructed and are now working many foreign academies, for example, the National Academy of Sciences of the USA or the Royal Society of Great Britain. The academy began to play a special role in our country in the years of the first five-year plans, when it was transformed more and more into a center of theoretical investigations, the headquarters of science. What has been said applies completely also to the Ukrainian academy.

Our president, Academician B. Ye. Paton, has spoken of the three whales on which the Academy of Science of the Ukraine now stands. First of all, there is basic scientific research, the base and the principle without which any sort of development or advance is impossible. Then there is applied research and experimental design developments for various sectors of the national economy. And there also is the direct participation of scientists in the introduction of the latest achievements of science into practice.

All three directions are firmly interconnected and we consider each is unthinkable without the others. Stressing basic scientific research (the ratio of basic to applied problems is 2:1 with us) we do not at all tear ourselves away from the "soil." It is precisely on the basis of the latest results of solid basic research that our scientists do much to increase the efficiency of the national economy which--and we understand this well--expects from science today the development of technologies new in principle, capable of increasing labor productivity, assuring a saving of materials and improving the quality of production.

Today 70,000 persons engaged in science and so-called scientific servicing are working in the Ukraine in institutions of the Ukrainian Academy of Sciences. They include 30,000 scientific associates and among them, in turn, are over 7,000 candidates and doctors in science, over 300 academicians and corresponding members--an enormous army of very highly qualified specialists. Hundreds of millions of rubles are expended annually on scientific research and the nation and state have the right to expect a high yield from high expenditures.

Well, if the term "strategy of introduction," that is such a favorite of journalists, is used, it should be acknowledged that we now vary that strategy by starting from the requirements of time. Without rejecting at all the traditional forms of connection of science with production, which can be conventionally designated as "institute-plant," we are proceeding more and more in practice to formulas of the type "institute-sector" or even "institute-sectors." This is achieved by the compilation of joint complex programs by the two interested parties, the institutes of the Ukrainian SSR Academy of Sciences and the ministries.

At the present time joint plans are being accomplished with the union ministries--of the chemical, petroleum and aviation industries, of chemical and petroleum machinery building, and with union-republic ministries--of the petroleum refining and petrochemical industry and non-ferrous metallurgy and, in addition, with republic ministries of ferrous metallurgy, geology, power and electrification, the meat and milk industry, public health, etc. As an example I would cite the purposive complex program entitled, "Increase of the working efficiency and improvement of the use of the depths of quarries of ore-enrichment combines of the USSR Ministry of Ferrous Metallurgy." Eighteen themes of scientific research work are designated in it. The country's first experimental production section with a continuous technology of production will be created. Eight academic institutes, sector scientific research and planning-design organizations, ore-enrichment combines and industrial enterprises are being drawn into the work. Participating in the program are six academicians and corresponding members of the Ukrainian

Academy of Sciences, seven doctors and 30 candidates in sciences. The scientific leadership has been assumed by the Institute of Geotechnical Mechanics of the Ukrainian Academy of Sciences.

We are also applying a not quite usual form of connection of science with production: we are organizing sector labs to complete the development of novelties with the staffs and allocations of an interested sector. The scientists have the scientific leadership. After a problem has been solved (the problem can be important but fairly narrow) the laboratory ceases to exist. A sector laboratory was created, for example, by joint resolution of the presidium of the Ukrainian SSR Academy of Sciences and the USSR Ministry of Land Reclamation and Water Resources, when the idea of using explosives in a new way for the construction of reclamation objects was born in the Institute of Geophysics of the Ukrainian Academy of Sciences. Today in institutions of the Ukrainian Academy of Sciences thereaare about 30 sector laboratories of 16 union ministries. The annual saving amounts to millions of rubles.

Scientific aad technological complexes also permit accelerating the introduction of the results of scientific research into practice. They include an adademic institute and khozraschet organizations subordinate to it, and also contracts on creative collaboration with enterprises and institutions.

Thus we are carrying out (and intend to continue doing so in the future) the instructions of the party to be constantly concerned "about the actual transformation of science into a direct productive force." The Ukrainian SSR Academy of Sciences is the coordinator of all scientific work in the republic. It orients scientific research institutions toward clearly determining positions in their activity, designating the most promising directions of development not only of science itsèlf but also of technology and the economy. Ideally each academic institute ought to actively influence the formation of the scientific and technical policy in its area. If, for example, the level of mechanization of welding work on the whole in the Soviet Union has reached 56 percent today, exceeding the foreign level, that occurred to a significant degree thanks to the work of the Institute of Electric Welding of the Ukrainian Academy of Sciences.

The 25th CPSU Congress called upon scientists to concentrate attention on the most important problems of scientific, technological and social progress, on the solution of which the successful development of the economy, culture and science itsèlf will depend to a very great degree. But there are many problems. In our opinion, it would be futile for the republic academies to strive for the development of all the major problems of science, assuming the functions of the USSR Academy of Sciences. We have our own goals. We are combining forces and material resources in those scientific directions where the republic occupies (or can occupy) leading positions in order to gring the greatest benefit for all Soviet science, the main task of which includes "increase... of the contribution to the solution of urgent problems in building the material and technological base of communism."

This is a jubilee year for us--the Ukrainian Academy of Sceinces is 60 years old. We can note with satisfaction that the practical results of the activity of the UkrSSR Academy of Sciences are very perceptible on the scales of the entire national economy. I could refer to the useful experience in collaboration of institutes of the Ukrainian Academy of Sciences with the Moscow "AvtoZIL" Association. Today they are collaborating closely on 28 major perspective themes. The experience proceeds in accordance with a plan for joint scientific research work which anticipates the creation and introduction of new technology and equipment into production in the course of the period 1976-1980. The developments of scientists of the Ukrainian Academy of Sciences have advanced far beyond the limits of the republic. They are being successfully used at construction sites of the Volzhskiy Motor Vehicle Plant and the KamAZ, a special-design blast-furnace at Krivoy Rog and a "3600" mill at "Azovstal'", on the Baykal-Amur main line, the Tyumen'-Tsentr gas pipeline, the Chernobyl'skaya atomic power plant, etc.

In this, the Tenth Five-Year Plan the scientific research institutions of the Ukrainian Academy of Sciences are participating in 90 programs instituted by the State Committee for Science and Technology under the USSR Council of Ministers. The scientists of the Ukraine have obligated themselves to fulfill almost 1500 tasks for various sectors of industry, including such important ones as machine-tool building, ferrous metallurgy, coal and electrical equipment. Work on welding, automated management systems, environmental preservation and many other areas has an inter-sector character, which was discussed above in fairly great detail.

The Tenth Five-Year Plan of the Ukrainian Academy of Sciences consists of 440 projects on 16 complex plans which are being carried out today in the institutions of the Academy of Sciences of the Ukraine jointly with the ministries and departments. Twenty-one complex scientific-technical and socio-economic programs are now being developed. This has meant a saving of almost 700 million rubles in just the first 3 years of the Five-Year Plan.

It is extremely important to note that the experience of our academy has been discussed by the secretariat of the CC CPSU and has been approved. "The UkrSSR Academy of Sciences is purposefully orienting scientific research work toward rendering aid to industry and agriculture," said Leonid Il'ich Brezhnev at a meeting with leaders of the academies of sciences of the socialist countries. "Collectives of the Ukrainian scientific research institutes have developed many advanced technological processes and production equipment new in principle. Completely planning all the work, from scientific idea to its practical implementation, the Ukrainian scientists achieve substantial curtailments of the periods required for introduction of the results of scientific research into practice. It has been calculated that each ruble of resources invested in the development of science in the system of the Ukrainian Academy of Sciences will give a return of the order of five rubles."

We cannot help but be gladdened by those words containing a high valuation of our labor. However, we do not think that everything possible has been

done. We will also apply in the future every effort to concentrate our investigations on the most urgent scientific problems, to expand and deepen our scientific research in order to contribute to the acceleration of scientific and technological progress and the growth of the efficiency of production.
[343-2174]

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B. Unified System or Ryad Series

COMPATIBILITY BENEFITS OF UNIFIED SYSTEM COMPUTERS

Moscow PRIBORY I SISTEMY UPRAVLENIYA in Russian No 7, 1979, outside back cover

[Advertisement placed by ELORG for Unified System computers]

[Text] [Slogan]

Compatibility of Unified System [ES] computers permits the effective organization of the work in computing centers of diverse configuration.

[Data table]

Computer Model	Size of Operating Memory (kilobytes)	Average Performance (thousands of operations per second)	Multiprogram Operation
ES 1022	512	80	15 working programs simultaneously when processor and peripheral devices are operating in parallel
ES 1033	512	140-200	
ES 1035	512	140-160	
ES 1060	8,192	1,300	

[Sales pitch]

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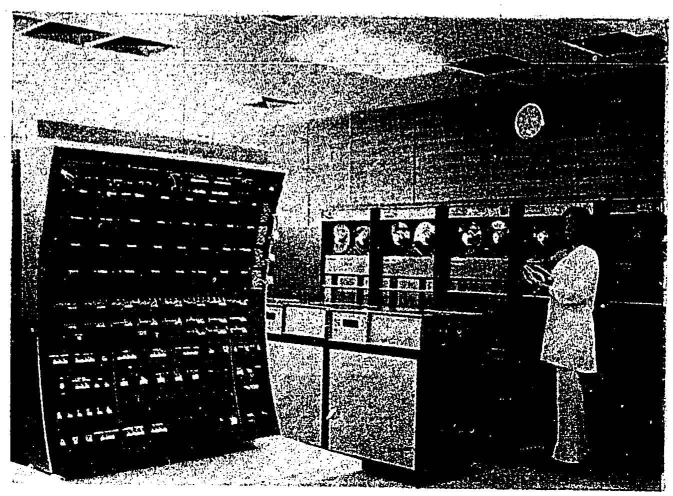

Figure 1.

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C. Hardware

VTO ISOTIMPEX DISK PACKS

Moscow PRIBORY I SISTEMY UPRAVLENIYA in Russian No 7, 1979, inside back cover

[Advertisement placed by the Vneshtorgreklama All-Union association for disk packs manufactured by VTO Isotimpex in Bulgaria]

[Text]

Parameter	Type of Pack			
	ES 5053	ES 5261	ES 5269	IZOT 5266
Capacity in Mbits	7.25	29/58	2.45/5	100
Number of disks	6	11	1	12
Number of sides used for recording	10	20	2	20
Track density (in tracks per inch)	100	100/200	100/200	200
Recording density (in bits per inch)	1,100	2,200	2,200	4,400
Disk pack compatible with	IBM 1311 or equivalent	IBM 2314 or equivalent	IBM 5440 or equivalent	IBM 3300
Specification number	2864	3564	3562	4337

[Slogans]

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[Vneshtogreklama text]

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Figure 1.

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ELECTRO-OPTICAL CONTROL OF MNOP MEMORY MATRICES

Moscow PRIBORY I SYSTEMY UPRAVLENIYA in Russian No 9, 1979 pp 32-33

[Article by B.I. Borde, candidate in technical sciences, and V.L. Kuznetsov, engineer: "Electro-Optical Control of Memory MNOP-Matrices"]

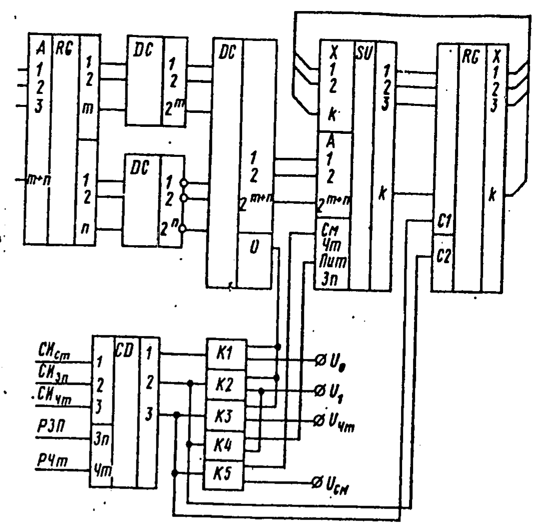
[Text] Permanent semiconductor memory units (PPZU; postoyannyye poluprovodnikovyye zapominayushchiye ustroystva) with electrical transcription and storage of data during power interrupts are promising elements of electronic computer systems [1]. Industry is producing matrices of the 519RYe1 and 591RYe2 types for the PPZU with memory elements based on MNOP-transistors [2, 3].

On the basis of 519RYe1 matrices with a capacity of 16X8 bits it is possible to develop read-only (ROM) and random-access memory (RAM) devices with a low speed but with storage of the data during power interrupts. For instance, RAMs of this type can be used in peripheral devices of computer systems. Primarily ROMs are created on the basis of the 519RYe2 matrix with a capacity of 64X4 bits with a partial decoding circuit, since the organization of this matrix provides for data transcription along the whole string (four four-bit words).

The main difficulty in developing control devices for the permanent semiconductor memory units on the basis of the MNOP memory matrices consists in the use of relatively high voltages (in the limits of ± 50 volts) for recording and erasing data. Commutation of such voltages with the logic integrated circuits existing at the present time is impossible. Recommended for control of the transcribing of data in the PPZU are circuits on sets of high-voltage transistors [3]. The most essential shortcoming of such circuits is the large number of elements. In general form for a RAM on the basis of 519RYe1 matrices, the capacity of which is N words, the address processor contains 4(N+1) transistors and 9N+10 resistors.

In order to simplify the RAM control unit on MNOP matrices it is proposed to use electro-optical keys. A photoresistor or phototransistor can be used as the photo-detector of the optron [4]. The merit of the electro-optical key is the possibility of commutation of voltages of great amplitude of different polarity (respectively up to ±30 and ±250 volts for transistor and resistor optrons). For a RAM with a capacity of N words on the basis of the 519RYe1 matrices the address processor contains N+3 optrons and N+3 resistors (with agreement with the transistor-transister logic integrated circuits). This is considerably less than in a control circuit based on transistors. In coordination with the k-MDP [metal-insulator-semiconductor] integrated circuits in the control circuit one transistor and resistor is added for each optron.

The main shortcoming of the electro-optical keys is the comparatively long switching time. However this shortcoming does not have an essential effect on the access time when using the MNOP-matrices in the RAM circuits. In this case the entry-read out cycle is fundamentally limited by the time necessary for erasing and entering the data in the cell, which for the series 519 MNOP matrix is 2-5 milliseconds for erasing and just as much for entering the data [3].



Functional Diagram of PPZU (Permanent Semiconductor Memory Unit) With Electro-optical Control: СИ$_{Ct}$, СИ$_{Зп}$, СИ$_{Чт}$ -- synchronous pulses respectively for erasing, entry, read-out; C1 -- synchronous pulse for entering data in the register; C2 -- synchronous pulse for outputting data from the register

The functional diagram of a PPZU with electro-optical control is presented in the figure. The unit includes register RG of address A, address decoders DC of the first and second stages, and register RG of number X, serving for exchange of data with the semiconductor accumulator SU. The operating regimes of the PPZU are determined by the write-enable signal P3n and the read-enable signal P4t, entering the decoder of regime CD. The decoder processes the signals controlling keys K1-K5, serving for receiving the code in the number register and outputting it from the register.

Used when developing the memory unit were MNOP-matrices of the K519RYe1 type, in which the total output of the matrices is switched in to the power potential (+10 volts) for coordination with the k-MDP integrated circuits. In this case corresponding to voltage U_0 of erasing is +58 volts, to voltage U_1 of entry, -38 volts, and corresponding to voltage U_{u_π} of read-out is +3.5 volts. These voltages, depending on the unit's operating regime are commutated by electro-optical keys K1-K3 to the common line 0 of the second-stage address decoder, formed by light-diode optrons, which commutate the voltage levels at the address inputs of the MNOP-matrices. In the entry regime key K4 commutates the entry power and bias voltage (-38 volts), and in the read-out regime key K5 switches in voltage U_{Cm} (-14 volts).

Comparative characteristics by the number of elements in the RAM control circuits on the basis of the 519RYe1 MNOP-matrices are presented in the table. The calculation was done for memory units with a capacity of 64 32-bit words.

Control circuit	Number of transistors	Number of optrons	Number of diodes	Number of resistors
Using transistors	260	--	--	586
Using electro-optical keys of the light-diode--photo-diode type	132	128	64	200
Using optrons of the light-diode--photoresistor type (agreement with TTL)	5	67	--	70
Using optrons of the light-diode--photoresistor type (agreement with the MDP)	68	67	--	130

An electro-optical RAM control circuit for 16 two-byte words has been tested and is being used in an operating system.

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10908
CSO: 1863

D. Programming and Software

UDC 681.3.06:331.015.11

SOFTWARE FOR DIALOGUE BETWEEN OPERATOR AND A CONTROL SYSTEM BASED ON THE M-6000 AUTOMATED SYSTEM OF COMPUTING TECHNICS (ASVT)

Moscow PRIBORY I SISTEMY UPRAVLENIYA in Russian No 6, 1979 pp 1-3

[Article by D. N. Kan, I. N. Lukach, and S. B. Nepomnyashchiy, engineers, and Yu. P. Savitskiy, candidate in technical sciences]

[Excerpts] One condition for the smooth performance of an ASU TP [automated management system for technological process] incorporating a human operator is that the system software includes a complex of algorithms and routines for information interchange between the operator and the control computer. Because the SPO-6000A system, supplied by the manufacturer, had no interactive software it was necessary to write it as custom software for a particular ASU TP.

A complex of these algorithms (programs), called "Pul't," was developed in the VIASM [All-Union Scientific Research and Design-Planning Institute for Automation of Enterprises in the Construction Materials Industry] (Leningrad). The complex is a component part of the custom software for the ASU TP for making construction materials. When the Pul't man-machine interactive routines were written, operating experience with similar systems based on the Dnepr-1 and Tbilisi-1 control computers was used. With allowance for this experience and based on the functions of the input/output devices that are part of the ASVT [automated system of computing technics] nomenclature, the main specifications for organizing the Pul't routines were drawn up.

1. At any arbitrary moment, the operator must be able to input or to query necessary data from any input/output device in the ASU TP. This is because the input/output devices can be placed in different rooms and, in addition, the input/output devices are much less reliable than the control computer electronic devices.

2. The information inquiry and input forms must be standradized independently of the type of input/output device.

3. Erroneous information caused by improper operation actions must not be allowed to be inputted into the control computer, since it can gravely upset the normal course of the industrial process.

4. The information placed in the control computer must be recorded; this is obligatory also when the SID-1000 display console is used as the input device.

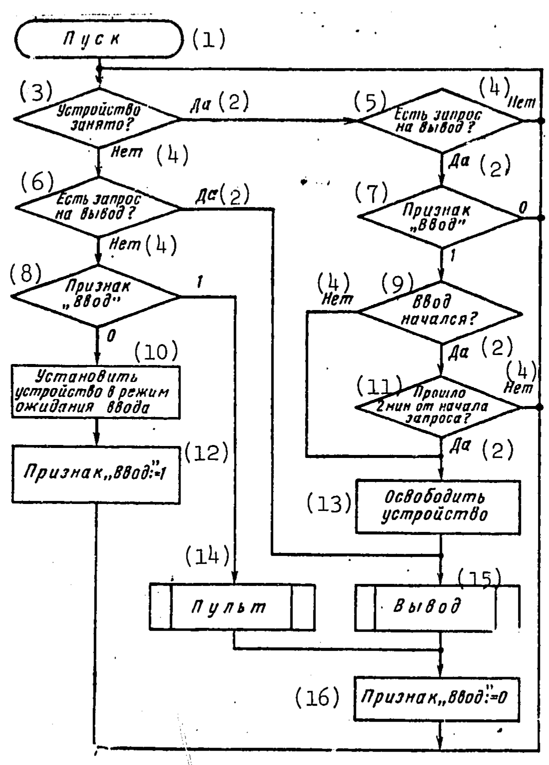

Fig. 1

Key:
1. START
2. YES
3. EQUIPMENT BUSY?
4. NO
5. INQUIRY AT OUTPUT?
6. INQUIRY AT OUTPUT?
7. "INPUT" CHARACTER
8. "INPUT" CHARACTER
9. INPUT BEGUN?
10. PLACE EQUIPMENT IN INPUT WAITING MODE
11. 2 MIN ELAPSED SINCE INQUIRY?
12. "INPUT":=1 CHARACTER
13. CLEAR EQUIPMENT
14. CONSOLE
15. OUTPUT
16. "INPUT:"=0 CHARACTER

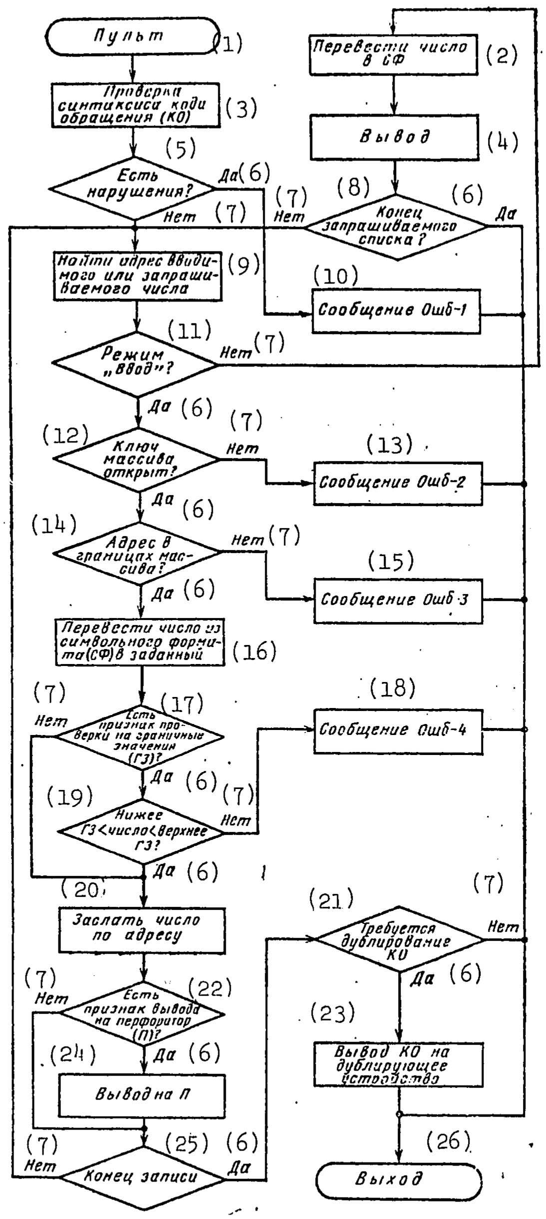

Fig. 2 [Key on next page]

Key:
1. CONSOLE
2. CONVERT NUMBER INTO SYMBOLIC FORMAT
3. CHECK SYNTAX OF ACCESS CODE
4. OUTPUT
5. ANY DISTURBANCES?
6. YES
7. NO
8. END OF INTERROGATED LIST?
9. FIND ADDRESS OF INPUTTED OR INTERROGATED NUMBER
10. MESSAGE OSHB-1
11. "INPUT" MODE?
12. FILE KEY OPEN?
13. MESSAGE OSHB-2
14. ADDRESS IN FILE BOUNDS
15. MESSAGE OSHB-3
16. CONVERT NUMBER FROM SYMBOLIC FORMAT TO GIVEN FORMAT
17. IS VERIFICATION CHARACTER AT BOUNDARY VALUES?
18. MESSAGE OSHB-4
19. LOWER BOUNDARY VALUES LESS THAN NUMBER LESS THAN UPPER BOUNDARY VALUES
20. TRANSFER NUMBER ACCORDING TO ADDRESS
21. DUPLICATION OF ACCESS CODE IS REQUIRED
22. IS OUTPUT CHARACTER AT PUNCH?
23. OUTPUT OF ACCESS CODE AT DUPLICATOR
24. OUTPUT AT PUNCH
25. END OF ENTRY
26. OUTPUT

The functional capabilities of the Pul't program permit its effective use when the composite program is thoroughly debugged in the object of application. For changes to be inserted into individual monitoring and control programs, the composite program base is inputted as the address of one of the files services by the Pul't program. All the changes ("patches") are inserted into absolute addresses in the octal number format. Editing of the programs, including the assembly of a new absolute tape, is done after trial commercial use. And for purposes of memory economy, a "truncated" version of the Pul't program can be incorporated in the composite program, that is, a version without auxiliary modes. The truncated version occupies (0.6-0.8) K words (depending on the size of the interactive table), while the complete version occupies (1.2-1.3) K words.

At present the Pul't program is part of custom software of the automated management system for technological processing that is in use at a number of construction materials industry locations.

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II. ECONOMIC APPLICATIONS

A. Bloc Cooperation

LATEST COMPUTER EQUIPMENT AT INTERNATIONAL EXHIBITION

Riga AVTOMATIKA I VYCHISLITEL'NAYA TEKHNIYA in Russian No 3, May/June 79 p 96

[Announcement]

[Text] Unified System (YeS) Computer Equipment — Systems of Small Computers and Their Application"

Moscow, Exhibition of the Achievements of the USSR National Economy, Pavilion of the Chemical Industry and Technology, 14 June to 15 July 1979.

Systems of small computers are used in these areas:

- Process Control;
- Data Processing'
- Scientific-Technical Calculations;
- Processing Measurement Data;
- Office Work.

A broad assortment of user programs has also been developed for these purposes.

Peripheral devices:

- Magnetic Disc Stores;
- Flexible Magnetic Disc Stores;

- Modern Units to Prepare Data on Magnetic Tape;
- Punched Tape Input-Output Units;
- Alphanumeric Printers;
- Alphanumeric Displays.

Remote data processing units:

- Multiplexers;
- Commutators.

A broad assortment of terminals and subscriber points:

- Display and Terminals Based on Microprocessors;
- Subscriber Points with Display, Punched Tape Units, and Typewriters.

Measuring instruments for computer equipment:

- Instruments to Test Blocks and Assemblies;
- Automatic Measuring Devices;
- Special Benches to Measure Computer Equipment.

Training and education of specialists.

Comprehensive computer servicing.

Hungarian specialists invite you to the exhibit:

- Detailed Information;
- Consultation;
- Demonstrations;
- Prospectuses and Catalogs.

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B. Economic Control at Local Level

REPUBLIC AUTOMATED MANAGEMENT SYSTEMS DISCUSSED

Moscow VOPROSY EKONOMIKI in Russian No 9, 1979 p 157

[Article by N. Balashova: "Republic Automated Management Systems for the National Economy"]

[Excerpt] In recent years work has been conducted actively to set up Republic automated management systems (RASU) for the national economy. Devoted to this topic was the All-Union Conference "Automated Systems of Management of the National Economy of Union Republics," organized by the State Committee for Science and Technology and USSR Gosplan and held from 31 January to 2 February 1979 in Tallin. Taking part in the conference were representatives of the State Committee for Science and Technology and USSR Gosplan, councils of ministers and gosplans of the union republics, ministries and departments, scientific institutions and higher educational institutions. Discussion of the reports and speeches took place in plenary sessions and three sections (methodical bases of organizing RASU; data, mathematical and legal support; hardware).

The first automated management systems (ASU) for the national economy were started in Latvia, Belorussia and Uzbekistan. In Latvia the first phase of an RASU was put into operation on the basis of an automated data bank for providing data of the subsystems "population," "capital construction" and "municipal economy." Developed in Belorussia was an engineering plan of an automated system of data processing for directive agencies. The system makes it possible to analyze the effectiveness of public production for the republic as a whole, and for individual ministries, enterprises, oblasts, rayons and cities. Completed in Uzbekistan was the planning of the first phase of an RASU, and an experiment was performed regarding the interaction of ASPR [automated system for planning calculations] subsystems with ASU of 98 ministries, departments, associations and enterprises. Experimental operation of the first phase of the RASU began in 1979. Work on planning RASU is being done in other republics as well.

Republic networks of computer centers (RSVTs) and republic data transmission networks (RSPD) are being organized as a component of the State Network of Computer Centers (GSVTs) and the Statewide System of Data Transmission (OGSPD). The All-Union Scientific Research Institute of Problems of Organization and Control (VNIIPOU) under the State Committee for Science and Technology jointly with republic scientific organizations have prepared the methodical materials "Basic Principles for Setting Up a Republic Automated Management System" and "Methodical Instructions for Compiling the Planning Documents for Setting Up a Republic Automated Management System." A Council of Chief Designers of RASU was organized under the VNIIPOU and the section "Automated Systems of Management of the National Economy of Union Republics" was set up under the Scientific Council for Computer Equipment and Control Systems of the State Committee for Science and Technology and the Presidium of the USSR Academy of Sciences.

It was noted at the conference that interrepublic coordination and organization of cooperative projects on problems of RASU and problems of interaction of operating and set up of ASU is still being done poorly, and that model planning decisions have not been worked out. Available experience is not used sufficiently when setting up republic automated management systems and economic substantiation is not performed when selecting the priority subsystems and problems. The recording of outlays for automation of management and the saving from these methods has not been properly organized. The capacities of computer centers are not utilized fully, and the deadlines for installation and assimilation of electronic computers are being drawn out. Adequate attention is not being given to complete outfitting of automated management centers with modern technical equipment. Centralized servicing of computer hardware is not being provided in full measure.

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C. Supply System

UDC 658.78.011.56

MANAGEMENT SYSTEM FOR A TALL PIECE GOODS WAREHOUSE

Moscow PRIBORY I SISTEMY UPRAVLENIYA in Russian No 9, Sep 79 p 16

[Article by Ts. V. Lakov, N. B. Khadzhistamov, L. N. Boyadzhiyeva and K. S. Benev, engineers (Bulgaria)]

[Text] The processes of intensification and concentration of production are resulting in a change in the functions of the warehouse in industry and commerce. The warehouse is being transformed from a place where goods are stored to a production regulator and a commercial distribution center. These changes require the enlargement of warehouses and the extensive use of computer technology to control them.

This article is devoted to the description of an ASU [automatic management system] for the technological process of receiving, storing and dispatching goods in a warehouse. The goods are stored on standard pallets; they may be as large as 1,200 x 8,400 x 600 mm and may weigh up to 1 ton. The warehouse's shelving assembly consists of two 10-deck shelves. The movement of goods units (GYe) -- the pallet together with the goods on it -- is accomplished by a transportation system (TS) that consists of roller and chain conveyors and two stackers.

The warehouse is controlled by the ASU, which consists of hardware, software and maintenance personnel (an operator managing the receiving operations and one managing dispatching). The system's technical structure includes the following equipment: a relay system for controlling the conveyors; electronic systems for controlling the stackers; automatic digital scales; a circuit control device; a process-control computer complex (UVK).

The process-control computer complex is based on the Bulgarian IZOT 0310 minicomputer and consists of the following units: the IZOT 0310, which is a processor with a 32K-word main memory, an asynchronous multiplexer and a digital input-output system; a DZM-180 series mosaic printing unit; two MT-19 consoles for manual input and retrieval of information.

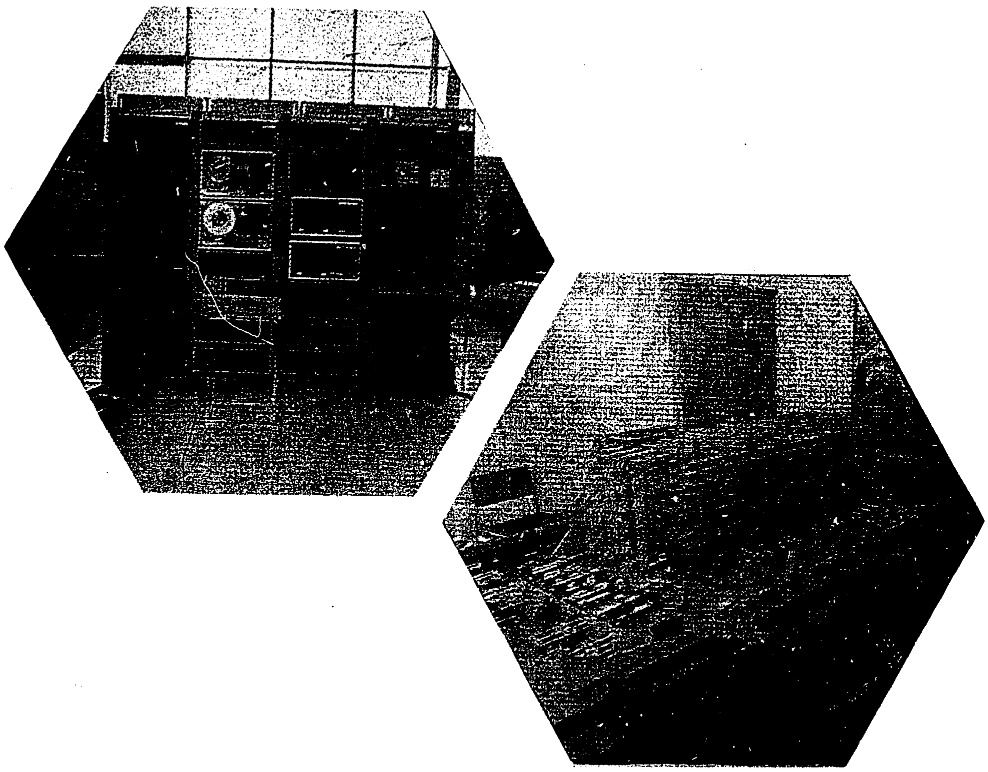

Figure 1. System for managing an automated, high-shelf warehouse that is based on an IZOT 0310 computer (upper left) and a model of a modern, automated, high-shelf warehouse (bottom right).

The software consists of an OSRV 310 real-time operating system and a "Warehouse 2" package of applied programs. The UVK complex operates in the multiprogram mode. The ASU carries out the following functions on a real-time scale: collecting and recording information; controlling the transportation system; processing dispatch orders.

In performing the "Information Collection and Recording" function, the ASU solves the following problems: manual and automatic collection of information about a GYe; recording of entered information about a GYe; recording of information on the state of the equipment and the operators' actions; output of the collected information on punched tape.

The operator enters the following information about each arriving GYe: pallet type and number, the supplier's code, product list number, quantity and unit of measurement of the specific article. These data are needed in order to control transportation of the GYe and compile the report on the warehouse's operation. When the system is functioning, there is continuous printing of a record containing information on: each received or dispatched GYe; the state of the stackers (type and time of beginning and ending of any accidents); forced interventions on the part of the operator in order to manage GYe transportation.

Information on received and dispatched GYe's and the state (occupied or free) of each storage space (SM) is entered on punched tape.

The following problems are solved during realization of the "Transportation Control" function: monitoring of incoming GYe's; determination of the addresses of the SM's in which they will be stored; monitoring and management of the movement of GYe's on the conveyors; monitoring and management of GYe transportation by the stackers.

The UVK complex monitors the reliability of the information entered by the operator. Each arriving GYe undergoes input monitoring of its size and weight, the result of which is a decision to send the GYe to the shelving area or to remove it from the TS. The latter decision is made in the following situations: when the pallet is empty or the GYe weighs too much; a deformed pallet; by request of the operator.

The address of the SM, which must be both accessible and acceptable, is determined for every GYe for which the decision is made to place it on a shelf. An accessible SM is one to which the GYe can be delivered over a section of the TS without an accident. Acceptability means that the SM is empty and located in the shelving zone required by the type of pallet and the goods' product list number. An SM is chosen on the basis of the following criteria: minimal transportation time (for receiving and dispatching); uniform distribution of goods with a single product list number throughout the shelves in the zone.

The transportation system is sectionalized. There is no more than one GYe in each section at each moment of time. Sectionalization of the TS makes it possible to realize effective monitoring of the GYe's being transported and avoid collisions. The ASU controls the movement of each TS section. Management of an individual stacker is accomplished with the commands "Determination of Information on the Stacker's State" and "Transport."

During performance of the "Process Dispatch Orders" function, the following problems are solved: receipt of the order; compilation of a list of GYe's from which the order can be filled; recording of the order.

An individual order contains information on the order number and data on the required goods: product list numbers, needed quantities and units of measurement. The order is filled if the needed amount of the required goods is in the warehouse. The goods unit on the list is determined by the criterion "first in -- first out." The GYe is automatically transported from the SM to the warehouse's dispatching point.

The described ASU can be used to manage a significantly larger warehouse than the one for which it has been realized. The maximum controllable TS is characterized by the following parameters: number of TS sections -- up to 512; total number of stackers and operator consoles -- up to 32; each section may adjoin no more than 3 other sections; the TS can have several parts that are not interconnected.

One UVK can control several warehouses. The "Transport Control" function is realizable for a maximum of 2,400 SM's, and the "Process Dispatch Orders" function for 260 SM's. If there are magnetic tape or magnetic disk or real-time disk operating system memory units in the UVK, the number of SM's possible increases to 20,000. The latter function can also be performed in a package processing mode. In this case, the result is read out on punched or magnetic tape and entered in the UVK from the operator's console, at his convenience.

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III. SOCIOCULTURAL AND PSYCHOLOGICAL PROBLEMS

A. Education

GRADUATE STUDIES AT LENIN INSTITUTE OF CONTROL PROBLEMS

Moscow PRIBORY I SISTEMY UPRAVLENIYA in Russian No 6, 1979 p 40

[Article]

[Text] The Order of Lenin Institute of Control Problems (Automation and Telemechanics) announces graduate study openings with or without job leaves in 1979 for the specialties of technical cybernetics and information theory; systems theory; theory of automatic control and regulation and systems analysis; elements and devices of computers and control systems; automated information processing and control systems; automatic control and regulation; industrial process control; control of moving objects; control in social and economic systems; systems programming; and organization of structures and computing processes in computers, complexes and systems.

Individuals not older than 35 years of age are admitted to graduate study with job leaves, and individuals not older than 45 years of age are admitted without job leaves, if they have completed higher education, have shown aptitudes for scientific research and have practical experience in the profile of the selected specialty for not less than two years after graduating from an institution of higher learning.

Individuals applying for graduate study take competitive (entrance) examinations in their specialty, history of the CPSU and in one of the foreign languages in the scope of the existing curriculum for institutions of higher learning.

Declarations are accepted from applicants for graduate study at the institute are accepted up to 1 September. Declarations must be sent to the institute director at the following address: 117342, Moscow, V-342, Profsoyuznaya ul., 81, with an appendix: 1) a notarized copy of the diploma for graduation from the institute of higher learning and an excerpt from the record register (the diploma is presented in person); 2) a personnel form from the personnel department with three photographs (3x4); 4) a personal history; 4) character references from the last place of work; 5) list of published scientific works, scientific and engineering reports and accounts of inventions with responses to same (individuals who have no scientific publications present written abstracts in their selected specialties); 6) reports on the condition of health with an indication of suitability for instruction in the graduate study department (Form No 286); and 7) certificates under Form 3.2 on the passing of candidate-degree examinations provided under the given specialty for individuals wholly or partially passing candidate-degree examinations.

Individuals admitted to the competitive examinations are given a vacation of 30 calendar days (10 days per academic subject) for preparing for and taking the examination, with wages paid from the place of employment (Statute on Graduate Study).

Examinations are held from 10 September to 10 October.

Individuals enrolled for graduate study with job leaves are given stipends and have vacations of two months a year.

For more information, call these telephone numbers: city 334-90-11, extension 759.

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IV. INFORMATION SCIENCE

A. Information Services

UDC 621.398:338.005

DATA TELEPROCESSING SYSTEMS IN MATERIALS AND EQUIPMENT SUPPLY APPLICATIONS

Moscow PRIBORY I SISTEMY UPRAVELNIYA in Russian No 6, 1979 pp 15-17

[Article by S. B. Abramov, candidate in economic sciences, and E. L. Tsemakh, engineer, network of computer centers [SVTs] of USSR Gossnab]

[Text] The network of USSR Gossnab computer centers is the principal and most important part of the complex of technical facilities of the USSR Gossnab automated management system [ASU]. It was formed by merging around the Main Computer Center (GVTs) of USSR Gossnab, groups of computer centers (VTs) of territorial main administrations (administrations) of material and equipment supply (MTS), formed into clusters, by means of support computer centers built up from these computer centers. Thus, the structure of the network of computer centers is a two or three-step structure, in which the first level is the main computer center of USSR Gossnab, the second level is the support computer centers of the cluster associations and the third level is the remaining computer centers of the cluster associations.

Effective interaction of the large number of computer centers is characterized by wide use of communication channels and data transmission equipment (APD) between the computer center of the USSR Gossnab system and the computer centers of the nationwide and the sector ASU.

Achieving this interaction requires facilities that are called upon to interchange data over switchable telephone and telegraph communication channels, using low-speed and medium-speed data transmission equipment between the Main Computer Center of USSR Gossnab and the computer centers of the network, as well as between the computer centers of a single cluster and in the future also high-speed data transmission equipment over dedicated channels. This is dictated by the swelling volumes of transmitted data, the high requirements on their reliability and the stiffening of time constraints on data delivery; between the computer centers of the administrations and the lower-level enterprises of the materials and equipment supply system (warehouse enterprises for product shipments and wholesale trade complexes and stores).

The lower-level enterprises at which organizing on-site computer centers is not economically justified are equipped with terminals connected by communications channels with the computer of the administration computer centers.

Data interchange at present between computers in the network of computer centers for the tasks of the ASU "Metall" (recording the ordering of metal products by the Ukrainian SSR Main administration of the Metals Industry, recording metal products shipped as per Form 1-PS, recording the ordering of stocks and warehouse ordering) is carried out over telephone communication channels with the "Akkord-1200 PP" data transmission equipment interfaced with the "Minsk-32" computer through the "Minsk-1560" interfacer. This complex and the software developed by the "Ukrglavsnabsistema" production and technical department reliably transmits data at an effective rate of about 100 symbols per second.

The proposed arrangements interchange data in the tape-to-tape mode between "Minsk-32" computers and also between "Minsk-32" and "Minsk-22" computers. In the last case the "Minsk-22" is connected directly to the "Akkord-1200 PP" equipment. Data interchange is possible in the punched-tape-to-punched-tape mode with data transmission equipment (without computer participation). If for some reason one of the computers does not take part in the interchange system, the intermediate mode of punched-tape-to-magnetic-tape is used.

Data reception and transmission in the USSR Gossnab network of computer centers is achieved in accordance with quarterly schedules confirmed by the head of the Main Computer Center. During 1978, 560 communication sessions were held with 20 computer centers (Kiev, Minsk, Tallin, Riga, Rostov-na-Don, Sverdlovsk, Krasnoyarsk and others). During these sessions 320 files were transmitted and received. The total costs for data transmission were 70,000 rubles, with one document-line costing 7 kopecks for transmission.

The complex of data teleprocessing equipment for the lower-level enterprises consists of "Minsk-1560" equipment, the "Akkord-1200 PP" data transmission equipment, "Videoton-340" displays, "Soemtron-385" automatic electronic invoicers, RI-3501 and RI-4501 information recorders and teletypes.

An interfacer was developed for connecting the displays to the "Minsk-1560" equipment. Up to eight displays can be thus accommodated, and each of them can function in two modes: operating in the "communication channel"--during which data entered on the keyboard go into the communication channel and through the interfacer and the "Minsk-1560" unit into the "Minsk-32" computers; operating "by itself," when the data entered on the keyboard flash up on the display screen, are monitored and then are fed into the channel. Interrupts in the computer are carried out according to the first symbol, but reading of the screen contents is halted until arrival of the input termination command comes from the computer. A special combination serves as the input termination character.

Also used for connecting the "Soemtron-385" electronic invoicer is the interfacer; in turn, to it can be connected the displays and the electronic invoicer. A modem for operating over telephone (telegraph) communication channels is connected to the automatic unit at the output channels for the punched tape and the photoinput.

Plans for expanding the USSR Gossnab network of computer centers were drawn up for 1977-1980 in the Main Computer Center of USSR Gossnab; reflected in the plans are the leading aspects of using data teleprocessing facilities in the operating environment of the USSR Gossnab automated management system (ASU).

Analyzing the construction of the USSR Gossnab network of computer centers --based on the teleprocessing facilities of the Unified System of Computers--revealed that there is a theoretical possibility of constructing the network of computer centers based solely on series-manufactured facilities of the data teleprocessing system. It was recommended to use the data transmission equipment of the Unified System (YeS) of Computers, operating at speeds of 200-4800 baud and higher over different types of communications channels. In particular, at the first stage of building the network of computer centers data can be transmitted over general-purpose switchable telephone lines; here establishment, city and intercity telephone exchanges can be the switching centers. Later on, data can be interchanged by employing --with growing expansion and reaching of design capacity--the Nationwide Data Transmission System [OGSPD] with switching centers.

Transmission of data is proposed to rely mainly on MPD-2 (YeS-8402) and MPD-3 (YeS-8403) multiplexers installed in computer centers at different levels of the hierarchy, with terminal equipment as follows: RI-7501 information recorders, part of the Automated Primary Data Processing System (ASPI), YeS-7066 displays and AP-2 (YeS-8502, model 1) and AP-3 (YeS-8503) subscriber stations.

Data transmission multiplexers (MPD) interchange data with the multiplexing (YeS-8402 or YeS-8403) or selector (YeS-8403) computer channels via a standard input/output interface. The MPD-2 multiplexer is connected to the AP-2 station via a standard S2 junction and a modem-200 (YeS-8001). Serving as the MPD-3 linear adapter here is the AA-1 asynchronous adapter, operating with the AP-3 station via modem-1200 (YeS-8005) and the UZO-1200 (YeS-8122) error protection unit, connected to the adapter with an S3 junction.

For protection against data distortion in the AP-2 and AP-3 stations blockwise phasing is used; data are interchanged at speeds of 200 and 1200 characters/s, respectively, in the KOI-7 seven-element code. AP-2 and AP-3 subscriber stations function mainly in the autonomous operation and data transmission modes.

The MPD-2 and MPD-3 units are controlled with a system of commands formed by the basis telecommunication access method. In the future it is projected to convert to the general telecommunication access method.

When the types of data transmission facilities and their delivery schedules were being determined allowance was made for the delivery schedule and the schedule for attaining the design capacity of the Unified System computers in the computer centers of the administrations and the need for the interaction of computer centers in the systems environment mode of the network of computer centers.

Supplying the network of computer centers with data transmission multiplexers of the Unified System of Computers, expansion of the Nationwide Data Transmission System and attaining the design capacity of custom and systems software for data transmission will permit converting from the semiautomatic interchange mode to a qualitatively new, higher mode of operating environment with automatic program-controlled interchange, significantly extending the capabilities of data interchange.

Automated Information System for Management of USSR Gossnab [AISR]

The technical plans for the Automated Information System for Management of USSR Gossnab, developed in 1975 in the Main Computer Center of USSR Gossnab, designate the system facilities for automating data collection, storage, reduction and representation to the management of USSR Gossnab on fulfillment of the material and equipment supply plan, as well as the operating processes for the actual system of USSR Gossnab.

The complex of technical facilities (KTS) of the USSR Gossnab automated management system (ASU) for processing, storage and display to the management of necessary data and automating the processes of the acquisition, and conversion and transmission of these data at all levels of materials and equipment supply, is the equipment base of the Automated Information System for Management of USSR Gossnab (AISR).

Included as part of the complex of technical facilities of the AISR are facilities for data acquisition and transmission that provide for acquisition and transmission of the latter over telephone and telegraph communication channels with a given confidence level and rate; facilities for data inputting into computers from different media and communication channels, data processing and output on punched media, alphanumeric printers and directly into the communication channel; terminals for displaying operating data upon inquiry from the work station of the subscribers on the cathode-ray tube screen or outputting on a printer, as well as the organization of the interactive mode.

So besides conventional input/output facilities, this complex of facilities of the Automated Information System for Management of USSR Gossnab includes data transmission equipment for acquisition and transmission of operational data from their place of origination in the Main Computer Center of USSR Gossnab, and inquiry and presentation of reports at the subscriber work stations (central staff personnel of USSR Gossnab).

The terminal model was selected on the basis of small dimensions, noiselessness and convenience in operation, text editing capability, adequate operating speed for implementing the interactive mode, possibility of data transmission and protection against distortion during transmission and simplicity in maintenance.

Satisfying these requirements most fully are the AP-61 (YeS-8561, model 2) and AP-63 (YeS-8563) subscriber stations; they relate, respectively, to medium-speed interactive subscriber stations that are characterized by a small volume of inquiry data and data obtained in response from the computer, a short computer response time and a short interactive transmission equipment response time, providing the group of subscribers with simultaneous operation from the central computer of the system over a dedicated communication channel and the outputting of data on the display screen or a typewriter.

The subscriber station complex is installed on the basis of the required number of subscribers (chairman of USSR Gossnab, his deputies, administration heads and others), numbering 14.

AP-61 and AP-63 subscriber stations use telephone communication channels for linking to the computers. And each AP-61 station servicing a single subscriber needs a separate channel; the AP-63 station is designed for simultaneous servicing of 16 subscribers on one communication channel. In the last case, operation of each subscriber depends on the operation of other subscribers and there may be situations when the communication channel will be busy. So an AP-61 subscriber station, for minimum response waiting time is made available to the USSR Gossnab chairman.

Data are fed from an electronic alphanumeric keyboard with direct transmission to the computer or by intermediate data storage in the memory block of the subscriber station, by display on a cathode ray tube screen or paper medium, editing and subsequent transmission to the computer.

Data queried from the computer or the results of a decision on a task fed into the computer is outputted on a printer or a cathode-ray tube screen (12 lines of 80 characters each). Data are interchanged between an AP-61 station and the computer in messages up to 960 characters long and in blocks of up to 80 characters long in codes (GOST 13052-74), between an AP-63 station and the computer in blocks up to 40 characters long or as whole messages up to 480 characters in length.

Interaction of the subscriber station subscribers with the computer is controlled by the following commands received from the computer: "READ" (from the cathode-ray tube screen or the typewriter), "READ COMPLETE BUFFER", "WRITE" (on the cathode-ray tube screen or the typewriter), "WRITE ADDRESS OF SCREEN LINE" and "ERASE/WRITE ON SCREEN".

The prepared message or part of it is transmitted to the computer after an inquiry is made by a subscriber and on the command "READ" from the computer. The results of processing the message on the command "WRITE" can be outputted from the computer at any line or position. To get a hardcopy of the message shown on the cathode-ray tube display, it is outputted on a typewriter.

Besides the subscriber stations installed at the subscriber locations, several terminals (YeS-7068) are placed in close proximity to the computer and serve for debugging and monitoring the system by the operating personnel.

The structure and the composition of the information fund of the Automated Information System for Management of USSR Gossnab impose certain requirements on the structure and composition of the information funds used at the lower levels of the USSR Gossnab system: building up of local files corresponding to a specific region of management activity. Storage of the files at the level of the central staff is provided for in the member of the computer at the Main Computer Center and at lower levels--at the administration computer centers.

The information fund composition is given in profiles: fulfillment of the plans for the production and deliveries of industrial products, the status of industrial products in reserve, availability of uninstalled equipment and fulfillment of the plans for self-financed capital construction and for financial-planning activity.

The complex of facilities of the Automated Information System for Management of USSR Gossnab is being introduced in two stages. At the first stage, the Automated Information System for Management of USSR Gossnab is introduced as a computer system forming output data in the mode of regulatory servicing of the USSR Gossnab chairman and his deputies with future expansion of the subscriber list.

As a result of the introduction of the first stage of the Automated Information System for Management of USSR Gossnab, schedules were shortened for the management of the corresponding information for controlling material and equipment supply. Thus, the schedule for presentation of quarterly data on the status of reserves in user locations was brought to 35 days through a reduction in the time for data processing in the computer center of the Administration of Materials and Equipment Supply [UMTS] obtained from users in the first 10 days of the months following the quarter of record and the possibility of outputting data on machine media into the Main Computer Center by the 15th of the month.

At the second stage the functions of the Automated Information System for Management of USSR Gossnab at the first stage will be expanded; also, the central staff personnel of USSR will be able to work in the interactive mode.

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UDC 681.327.3

LINKING AN "ELEKTRONIKA-60" MICROCOMPUTER TO A CAMAC "CRATE" TRUNKLINE

Moscow PRIBORY I SISTEMY UPRAVLENIYA in Russian No 7, 1979 p 11

[Article by Engineers R. V. Bocharova, Ye. V. Pankrats, and V. A. Timofeyev]

[Text] The variety of microelectronic computing devices that industry has been offering to designers of both automated management systems (ASU) and automated technical-process management systems has greatly expanded in recent times. Examples are microprocessor assemblies using the series 580, 590, and other microcomputer LSI circuits, among them the "Elektronika-60" microcomputer.

The microcomputer referred to is basically compatible in its programming with the M-400, SM-3, and SM-4 domestic minicomputers and is built using analogous architectural principles. It has a bus, which is the only trunkline for exchanging information among the separate components of the computer and external devices. The bus of the Elektronika-60 microcomputer differs from the above-mentioned computers in that it transmits address information and data sequentially along the same trunk circuit. There are also small differences in the list of signals that provide for direct access and for capturing the bus during program interrupt periods.

Small volumetric dimensions and cost of the microcomputer make possible its use in small local systems (when use of large computers or the installation of communication lines to computing centers is not economical) as well as in so-called field (expeditionary) systems, in which the use of computing devices signals a qualitative jump in organization and effectiveness.

For automating experimental research, increasing use is made of CAMAC equipment. Production of measurement-calculating devices incorporating SM-3 and SM-4 computers and CAMAC equipment has begun.

At the special design office of the Institute of Radio Engineering and Electronics of the Academy of Sciences of the USSR, equipment for interfacing the "Elektronika-60" with the CAMAC crate trunkline has been created. The basic component is a crate controller (KK) for the M-400 computer, which was developed in 1975 jointly with the Institute for Electronic Control Machines

(Moscow).* Thanks to the programming compatibility of the "Elektronika-60" with the M-400 computer and the identical assortment of signals used in their busses, the KK circuit design has remained unchanged. An additional element of the interface is the interface circuit board included in the design of the "Elektronika-60," which can be plugged into one of the unused bus plugs of the latter. The functional circuit of the circuit board is shown in Figure 1. It contains a bus formatter, an address buffer register, and an interrupt signal circuit.

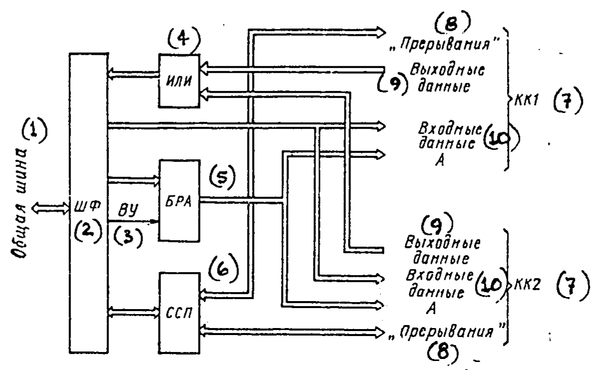

Figure 1.

Key:

1. Bus
2. Bus formatter
3. "External device" signal
4. [Logic] OR circuit
5. Address buffer-register
6. Interrupt signal circuit
7. KK
8. "Interrupt"
9. Output data
10. Input data

The bus formatter uses K589AP16 and K589AP26 integrated circuits. The circuit board is designed to operate with two KKs, for which reason data and corresponding synchronizing signals are applied to the bus formatters via the OR circuit. The address buffer register, which uses the K155IYe integrated circuit and contains the 13 bits A00 to A13, generates the address code A, which is received from the computer via the address bus and transmitted during the first portion of the access time. Bits A14 to A17 for the KK are formed by the VU (external device) signal arriving from the computer.

*Timofeyev, V. A., et al. "Crate controller for communicating with the M-400 computer" IN: "Avtomatizatsiya nauchnykh issledovaniy v khimii i khimicheskoy tekhnologii" [Automation of scientific research in chemistry and chemical technology], Baku, Elm, 1977.

The interrupt signal circuit provides for compatibility (between the M-400 computer and the "Elektronika-60") of the request signal for interrupting all other signals that accompany the capture by the KK of the bus, and for the transmission of the interrupt vector code to the computer. The interrupt signal circuit also provides for priority for one of the interrupt signals should they occur simultaneously from both KKs.

The external view of the interface circuit board is shown in Figure 2. The board contains 28 integrated circuits. For operation with a single KK, the number of integrated circuits can be reduced to 20.

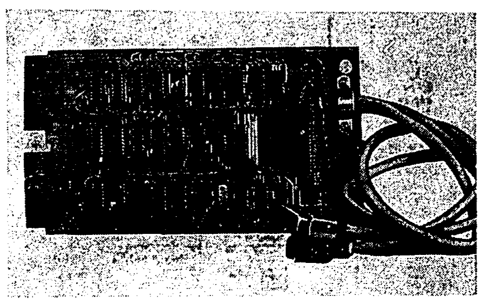

Figure 2.

The combination of the "Elektronika-60" microcomputer with CAMAC places the entire broad assortment of CAMAC modules at the disposal of small systems. The programming compatibility of the "Elektronika-60" with the SM-3 and SM-4 machines permits the preparation and execution of working programs for small systems on one of the computers mentioned, which have a large assortment of programs and peripheral devices (disk systems, alphanumeric displays, and so forth). Such an organization of work will permit the concentration of a library of different control and processing programs in one place, which, with the "library" of CAMAC modules, permits a rapid and effective automation of a large number of many different small systems.

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MULTI-CHANNEL SYSTEM FOR LOADING SEQUENTIAL CODE INTO AN M-6000 CONTROL COMPUTER SYSTEM

Moscow PRIBORY I SISTEMY UPRAVLENIYA in Russian No 7, 1979 pp 12-13

[Article by engineers M. Sh. Gofman, V. N. Troitskiy and N. M. Tsibulin]

[Text] In designing an automated technical process management system (ASU TP) based on the hardware system of the M-6000 type modernized automated system of computer technics (ASVT-M), for example, a system for monitoring (directing) the movement of transport in cities, a requirement exists for accepting discrete information that is transmitted from many sources using sequential code via duplex lines of communication that link the control computer system (UVK) to the signal sources. Information arrives according to the arrival of vehicles at the monitoring points.

Input of discrete information into the M-6000 UVK takes place along the chain: Input module for discrete information (MVDI) or input module for initiating signals (MVIS) or input module for numerical-impulse signals (MVChIS), then to the group-control module (MGU), then to the processor or the RVV* or the RS.* Here and below in the article, abbreviations are used that have been adopted in the technical documentation for the M-6000 hardware complex (KTS) (Refs. 1, 2). Input is possible only of information using a parallel or numerical-impulse code. Modules are not produced to receive information in a sequential code, which latter would have to be transformed into parallel form and input into the process control computer complex. Also, the input of data from modules in the UVK is accomplished by a programming method via sequential interrogation. Use of the indicated method leads to a nonproductive loss of machine time, as it is necessary to interrogate modules that have no information content.

In implementing the input of sequential codes into the M-6000 UVK, a specialized input module (MV) was developed at the Belorussian

*Expansion unknown

Scientific-Research and Technology Institute for Motor Vehicle Transport (Be NITIAT), which transforms a sequential code into a parallel one and provides operation via the 2K coupler, the MGU, or through the modernized group-control module (MGU-M). The program-controlled search for the MV ready to issue information is replaced by equipment search in the modernized MGU-M. The processor's processing time for the request just arrived becomes a constant value and is equal to the time of accessing two MVISs, which increases the effectiveness of using the processor (Ref. 1). Increasing the number of MVs is accomplished by standard peripheral MGUs connected to the central MGM-M, which permits colocation, based on typical designs and power supply units of the ASVT-M, of any nonstandard equipment and units, which provide for an exchange of information using the 2K couplers. The work-size of the communication being received has to be within MV limits (in this case, 16 bits).

The MV module is constructed on a type B circuit board, which carries the various integral and discrete components. It occupies a single space and can be located in the processor, RVV, RS, MGU, or MGU-M. A signal source connector is located on the board as well as a switching circuit whose location is determined by whether the MV is located at the MGU or the MGU-M.

The block diagram of the module is shown in Figure 1. The module consists of normalizing and shaping circuits (NF), shift register (RGS), static register (RG), counter (SCh), a circuit for generating the READY signal (SGT) (for the star-type network READY signal GTO-T and the trunkline READY signal GT-T1M) output gates KL and the control unit UU. The normalizing and shaping circuits transform the data pulses II and synchronizing pulses SI into rectangular shapes that satisfy the requirements of the series K-155 microcircuits and are identical to similarly named units of standard modules MVChIS-2 and MVChIS-3 (Ref. 3). The 16-bit shift register accumulates the arriving information. The sequential 4-bit counter generates the STROBE RG signal when the 16th synchronizing pulse arrives, causing a transfer of information from the shift register to the static register. The unit UU sequentially generates the following signals according to signals arriving from the MGU-M: The CHECK signal when the access signal VBRO-K and the ADDRESS GROUP signal coincide; the signal STROBE OUTPUT GATES when there is coincidence of the signals PR-KM, VBRO-K, and ADDRESS GROUP; the CLEAR signal, which configures the circuit to the initial state when the OST-KM signal arrives. During operation, the signals CHECK And STROBE OUTPUT GATE are formed simultaneously through the 2K coupler (PR-KM corresponds to a logic "1"), and the signal CLEAR following arrival of VP-K, the signal indicating execution of the input-output operation. In the diagram (Figure 1), the symbols for the control signals are indicated in parentheses and correspond to having the MV connected to the processor, RVV, or RS. The SGT circuit is active when the STROBE RG and CHECK signals coincide, with the MV connected to the MGU-M, or after receipt of the STROBE RG signal when operating through the 2K coupler. Information output from the RG register to the trunkline bus is done via output gates, when the strobe output gate signal corresponds to a logic "1". The algorithm for the operation of the MV via the MGU-M is shown in Figure 2. The MV operates via the 2K coupler in the same manner as an MVIS (A622-4).

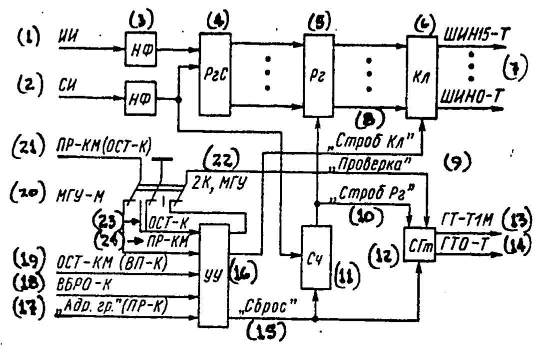
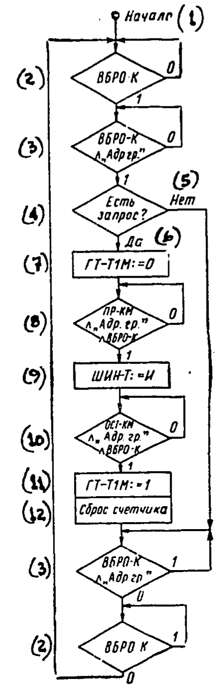


Figure 1. Block Diagram of Input Module

Key:

1. Data pulses
2. Synchronizing pulses
3. Normalizing and shaping circuits
4. Shift register
5. Static register
6. Output gates
7. Trunkline buses for transmitting signals from the input module to the BU-10 unit
8. Output gate strobe
9. Check
10. Static register strobe
11. Counter
12. Circuit for generating the READY signal
13. Star-type network READY signal
14. Trunkline READY signal
15. CLEAR signal
16. Control unit
17. "Address group" (signal indicating transfer of information from input module)
18. Access signal
19. OST-KM (signal indicating execution of input-output operation)
20. Modernized group-control module
21. PR-KM (signal indicating termination of input-output operation)
22. The 2K comparator located in the group-control module
23. OST-K (signal indicating termination of input-output operation)
24. PR-KM



Key:

1. Start
2. Access signal
3. Access signal ∧ "Address group"
4. Request present?
5. No
6. Yes
7. Trunkline READY signal
8. PR-KM ∧ "Address group" ∧ Access signal
9. Bus: = Information
10. OST-KM ∧ "Address group" ∧ Access signal
11. Trunkline READY signal: = 1
12. Clear Counter

Figure 2. Algorithm for MV Operation via an MGU-M

The time required for information transfer from a single MV installed in a nonmodernized MGU can be determined from the formula

$$T_o = T_p + N\,(t_r + t_d)$$

where T_p is the time from the moment of arrival of the GT-T1M signal to the beginning of the interrogation of the module; N is the number of MVs connected to the MGU; t_r is the time expended to interrogate a single module; t_d is the time for the pause between module interrogates.

If the module is installed in an MGU-M, then the time for transferring information from an MV is given by

$$T_{om} = T_p + 2t_r + t_d.$$

Table 1. BASIC TECHNICAL CHARACTERISTICS OF THE INPUT MODULE (MV)

Maximum speed of data input when operating with a 250-channel MGU-M (bits/s)	250
Direct current power supply voltage (V)	5 ± 0.25
Current demand (mA):	
In the initial state	400
At the moment of interrogation	800
Volumetric dimensions (mm)	235 x 144 x 12.5
Weight (kg) not to exceed	0.25

Information output occurs immediately via the 2K coupler, the MGU (A622-1), or the MGU-M.

Modernizing the central MGU consists of the addition of an address counter module and the MSA (Figure 3), which determines the MV address, generates the GT-T1M signal, and interfaces with the BU-10, BKP-309, BDSh-4, BNR-1, or MV blocks.

The MSA module consists of the SChA address counter, two groups of output gates, KL1 and KL2, the UG generator unit, and SOA circuits for processing the address. The SChA counter cyclically forms the MV address in the MGU-M or in a peripheral MGU and contains the modulo number equal to the number of MVs connected, whose interrogation is achieved by strobing the output gates KL1 and BDSh-4 blocks by the corresponding KL1 STROBE and DSh STROBE signals formed in the UG unit. The address is changed according to the arrival of timing pulses TI from the UG unit, which, during the operation of the SGT circuit (Figure 1) of the MV being interrogated, forms the GT-T1 signal (Figure 2), which in turn is transmitted to the BU-10 block and stops the SChA counter.

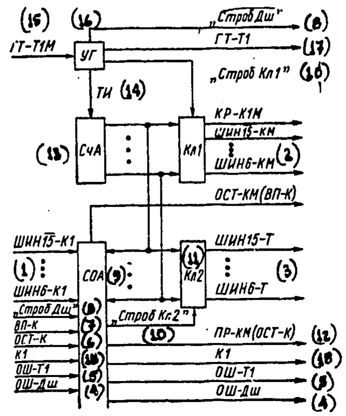


Figure 3. Block Diagram of Address Counter Module (MSA)

Key:

1. Data bus lines carrying MSA and requested input module addresses from the BU-10 unit
2. Address bus lines using single control bit going to blocks BDzh-4, BKP-309 for cyclical input module interrogation
3. Bus lines for transmitting signals from input module to BU-10 unit
4. Signal indicating error in MGU-M decoder (buses carrying signals with other designations are shown in parentheses)
5. Decoder error in peripheral group-control module
6. Signal indicating termination of input-output operation
7. Signal indicating execution of input-output operation
8. "Strobe decoder"
9. Address processing circuit
10. "Strobe output gate"
11. Output gate
12. PR-KM (signal indicating termination of input-output operation)
13. Address counter
14. Clock pulses
15. Trunkline READY signal
16. Generator unit
17. GT-T1
18. K1 - Parity error signal from block BKP-309 in the MGU-M

When the GTO-T signal arrives from the MGU-M, the processor addresses the MSA using the known access code, which is strobed by the potential STROBE DSh from the BU-10 block and is compared with the MSA hardware-generated address in the SOA circuit. When these two coincide, the STROBE KL2 signal is generated, which opens output gates KL2, and the MV address enters the processor. The latter turns to the MGU-M according to the accepted address, which then goes to the SOA circuit and there is compared to the address in the counter. When the two codes coincide and the STROBE DSh signal is present, the PR-KM signal is generated, which goes to the UU unit of the MV via the OST-K bus and reads the information from the connected MV. Arrival of the VP-K or OST-K signal from the BU-10 block causes the SOA circuit to issue an OST-KM signal via the VP-K bus to the UU unit of the MV. When this happens, the CLEAR signal is generated in the connected MV, the SGT circuit (Figure 1) returns to the initial condition, and the MSA renews the cyclical inquiry.

All information sent by the processor to the MGU-M has to be accompanied by control bits. Operation of the MGU is complicated in case of an erroneous situation, as can happen during the nonagreement of addresses issued by the processor with those in the MSA or the MV address. In this case, the SOA circuit does not issue the STROBE KL2 and PR-KM signals but issues the appropriate error code to the OSh-T1, K1, and OSh-DSh buses. Processing of the erroneous message can anticipate recording of the error and a repeated addressing to the MGU. If a triple request to the MGU-M does not yield the MV address, then the SOA circuit generates the OST-KM signal. The algorithm for the MSA operation is shown in Figure 4.

The speed R of transmitting data and the number N of channels is basically determined by time T_{om} and related in the following manner:

$$R \leq S/N\ (T_{om} + T_{pa} + T_{ti})$$

where S is the word size (in bits) of the MV ($S \leq 16$); T_{pa} is the pause time conditioned by the shaping of address in the MSA ($T_{pa} \ll T_{om}$); T_{ti} is the period for the timing pulses in the MSA.

For example, for N = 250 and $T_{om} + T_{ta} + T_{ti}$ = 250 microseconds, the maximum speed is 250 bits per second.

Application of the modules described permits an expansion of opportunities for designs using the M-6000 UVK multichannel system for input of discrete information.

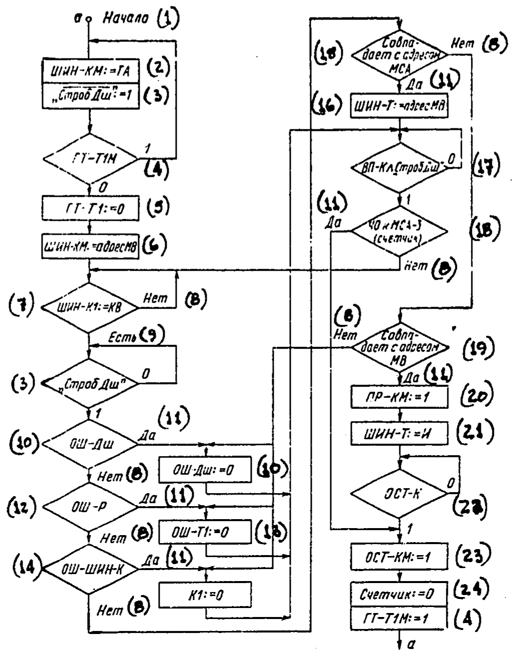


Figure 4. Operating Algorithm of Address Counter Module (MSA)

Key:

1. Start
2. ShIN-KM: = TA, where TA is the current address
3. "Strobe decoder"
4. Trunkline READY signal
5. GT-T1
6. ShIN-KM = MV address
7. ShIN-K1 = KV, where KV is the access code
8. No
9. Yes
10. Decoder error
11. Yes
12. Peripheral group-control module (MGU) error
13. Decoder error in peripheral MGU
14. Parity error
15. Coincides with MSA address
16. Input module (MV) bus: = input module address
17. VP-K ∧ "Strobe decoder," where VP-K is the signal indicating execution of input-output operation
18. MSA reference (counter)
19. Coincides with MV address
20. PR-KM: = 1
21. MV bus: = Information
22. Signal indicating termination of input-output operation
23. OST-KM
24. Counter: = 0

MNEMONICS:

ИИ	[II]	information pulses (data)
СИ	[SI]	synchronizing (clock)
НФ	[NF]	normalizing and shaping circuit
РгС	[RGS]	shift register
Рг	[RG]	static register
Кл	[KL]	output gate
Сч	[SCh]	counter
СГт	[SGT]	circuit for generating READY signal
ГТО-Т	[GTO-T]	star-type network READY signal
ГТ-Т1М	[GT-TIM]	trunkline READY signal
УУ	[UU]	control unit
ПР-К	[PR-K]	signal indicating transfer of information from input module
ВБРО-К	[VBRO-K]	access signal
ВП-К	[VP-K]	signal indicating execution of input-output operation
МГУ	[MGU]	group-control module
МГУ-М	[MGU-M]	modernized group-control module
ОСТ-К	[OST-K]	signal indicating termination of input-output operation
ШИН__-Т	[ShIN__-T]	trunkline bus for transmitting signals from the input module to the BU-10 control block
МВ	[MV]	input module
МСА	[MSA]	address counter module
ШИН__-К1	[ShIN__-K1]	Data bus lines carrying MSA and requested input module addresses from the BU-10 control block
ШИН__-КМ	[ShIN__-KM]	Address bus lines using single-bit control going to the BDsh-4 decoder block and to the BKP-309 block and used for cyclical interrogation of the input module

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3. Sokolov, A. V., et al. "Additional input modules for discrete information for the M-6000 process-control computer complex," PRIBORY I SISTEMY UPRAVLENIYA, No 4, 1977.

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CSO: 1863

UDC 002.66

HOW TO BEGIN SCIENTIFIC INFORMATION ACTIVITY

Moscow NAUCHNO-TEKHNICHESKAYA INFORMATSIYA. SERIYA 1 in Russian No 7, 1979 pp 1-2

[Letter from O. Ye. Buryy-Shmar'yan: "How Does One Begin Scientific Information Activity? (A Letter to the Beginning Information Worker)"]

[Excerpt] Letter Three*

The Technology of Information Work

> Information activity and information work is the totality of processes of gathering, analysis, conversion, storage, retrieval and dissemination of information (and also other auxiliary processes which support these main processes), carried out systematically by some organization (institution, subdivision, group of personnel and so on). Glossary of informatics terms.

Dear Colleagues!

Now when you have become somewhat acquainted with the bases of information work, I would like to dwell on organization of the State Scientific and Technical Information System (GSNTI) in our country. Every information worker must know the structure of the State Scientific and Technical Information System and his position and mission in this system.

GSNTI of the USSR is the world's first centralized information system. There is no system like this even in the more developed capitalist countries having long traditions of organizing scientific information activity.

The Leninist principle: "a little more study of that which our practical experience in the center and on the jobs provides and that which science has

* Buryy-Shmar'yan, O. Ye., "Letters to the Beginning Information Worker," NAUCHNO-TEKHNICHESKAYA INFORMATSIYA, SERIYA 1, No 4, 1978, pp 8-14; No 9, pp 10-15.

already given us"* was reflected in development of the GSNTI and is the creative embodiment of Lenin's ideas on scientific and technical information during the years of Soviet power and the constant concern of the Communist Party of the Soviet Union on further improvement of the scientific and technical information system in the country.

The information bodies in GSNTI are distributed on four levels, at each of which the corresponding information is studied and disseminated.

The first level includes the ten All-Union information bodies: the All-Union Institute of Scientific and Technical Information (VINITI), the Exhibition of Achievements of the National Economy of the USSR (VDNKh SSSR), the All-Union Institute of Intersector Information (VIMI), the All-Union Book Chamber (VKP), the All-Union Scientific Research Institute of Technical Information, Classification and Coding (VNIIKI), the All-Union Scientific and Technical Information Center (VNTITsentr), the All-Union Center for Translations of Scientific and Technical Literature and Documentation (VTsP), the State Public Scientific and Technical Library (GPNTB of the USSR), the Institute of Scientific Information on the Social Sciences (INION), the Central Scientific Research Institute of Patent Information and Technical and Economic Research (TsNIIPI).

The main task of each of these bodies is preliminary processing of a specific type of documents of the worldwide document flow. VINITI processes the flow of literature on the national and technical sciences, VNTITsentr processes reports on scientific research and experimental design development (NIOKR), TsNIIPI processes descriptions of inventions for authors' certificates and patents and so on. These bodies also formulate the descending flow of secondary information (abstract journals, express information, survey information and so on) and bring it to the user both directly and through the information network of the country.

The second level is the central sector scientific and technical information bodies (TsOONTI). These bodies, each by its topical direction (sector), receive the flow of documents from the All-Union information bodies and prepare factographic and generalized information necessary for effective operation of enterprises and organizations of the sector. They organize the ascending information flow on their topic. Each information service should operate in close contact with the TsOONTI of its own sector. So I again remind you: you must find out about your sector information body and establish the necessary contacts with it from the very beginning of your activity.

The third level is the territorial information centers (republic scientific and technical information institutes and intersector territorial scientific and technical information centers) and the sector information services

*Lenin, V. I., "Polnaya sobraniya sochineniy" [Complete Works], Fifth Edition, Vol 42, p 347.

attached to the republic ministries. These bodies provide information support support from the requests of enterprises of their own region and disseminate the advances of science and technology of their own republic (kray or oblast) by different sectors of the national economy and other regions.

The territorial information center is the organization in relationship with which you should begin your information work (there you will receive the necessary methodical assistance and there you will become familiar with the experience of the leading information services and will link up with them and will assist in initial acquisition of the fund).

And, finally, the fourth level is we with you, information services of organizations, enterprises and educational institutions: departments, offices, sectors and groups of scientific and technical information and also information workers.
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CSO: 1863

V. THEORETICAL FOUNDATIONS

A. Theory of Mathematical Machines

UDC 681.32.06

TIME EVALUATIONS OF ANALYSIS OF STATEMENT READINESS IN PARALLEL PROGRAMS

Riga AVTOMATIKA I VYCHISLITEL'NAYA TEKHNIKA in Russian No 3, May/June 79 p 93

[Abstract of article by V. V. Ignatushchenko and L. V. Karavanova]

[Text] This article evaluates the time of analysis of the trigger functions of statements. It shows that a sequential channel for processing trigger functions makes the time of analysis of trigger functions proportional to the number of statements in the program. In connection with this, several methods of reducing the time of analysis of trigger functions are considered and evaluated: introducing parallel access to several trigger functions; using supplementary control information; using associative data processing; consolidating statements. Tolerable levels are determined for the ratios of time of analysis of trigger functions to performance time of statements and program branches. The article has two illustrations and three bibliographic entries.

[349-11,176]

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VI. GENERAL INFORMATION

A. Conferences

UDC 681.3.001:65.011.56

KUYBYSHEV CONFERENCE ON AUTOMATING EXPERIMENTS REPORTED

Riga AVTOMATIKA I VYCHISLITEL'NAYA TEKHNIKA in Russian No 3, May/June 79 pp 87-88 manuscript received 19 Oct 78

[Article by V. I. Orishchenko: "Automation of Experimental Research"]

[Text] Automation of complex scientific-technical experiments based on the use of computer equipment opens up real opportunities to increase the efficiency of research in various branches of science and technology. In recent years considerable attention has been devoted to the multifaceted problem of automating experiments. Theoretical and practical problems in this area have been the subject of discussion at various conferences held in Moscow, Novosibirsk, Riga, Kuybyshev, Pushchino, and other cities. The regular All-Union Scientific-Technical Conference on "Automation of Experimental Research" was held in Kuybyshev on 5-7 July 1978. It was organized by the Council on Automation of Scientific Research of the Presidium of Sciences USSR, the Head Council on Control Systems and Automation Equipment of the RSFSR Ministry of Higher and Secondary Specialized Education, the Kuybyshevskaya Oblast Board of Directors of the Scientific-Technical Society of the Instrument-Making Industry imeni S. I. Vavilov, and the Kuybyshev Order of the Labor Red Banner Aviation Institute imeni Academician S. P. Korolev.

More than 250 representatives of 52 organizations from 25 different cities in the country participated in the work of the conference. Seven reports were given at the plenary sessions and 133 reports and communications were discussed at meetings of the following sections: theory of the controlled experiment; designing and simulation of systems to automate experiments; measuring-computing complexes; software for systems to automate experiments; digital signal processing; systems for collection of measurement information; systems for displaying experimental data; training of specialists in the field of automation of experimental research.

At the first plenary session the report "Program for the Development of Work in the Field of Automation of Scientific Research" by B. N. Petrov and G. N. Kuklin of Moscow was heard with great interest. It summarized work on development of automated systems for scientific research (ASSR) at organizations of the Academy of Sciences USSR and the academies of sciences of the Union republics. The basic directions of the long-term program to automate experimental research, which envisions cooperation among the Academy of Sciences USSR and various ministries, were set forth. It was observed that measurement-computing complexes based on SM-3 and SM-4 computers and CAMAC apparatus are envisioned in designing automated systems for scientific research.

At later plenary sessions the following reports were heard: "Program of the State Committee for Science and Technology of the USSR Council of Ministers for the Development of Work on Automation of Scientific Research and Full-Scale Testing of Models of New Technology Until 1990" by O. S. Zudin (Moscow); "Measurement-Computing Complexes in Systems for Automation of Scientific Research" by G. I. Kavalerov and S. M. Mandel'shtam of Moscow; "System of Small Second-Phase Computers" by B. N. Naumov and S. N. Krushchev of Moscow; "Work of the Siberian Department of the Academy of Sciences USSR on Automation of Scientific Research" by Yu. Ye. Nesterikhin of Novosibirsk; "Comprehensive Program of the RSFSR Ministry of Higher and Secondary Specialized Education for Automation of Scientific Research" by Victor A. Vittikh of Kuybyshev.

Eighteen reports were heard at sessions of the section on "Theory of the Controlled Experiment." These papers discussed the principles and algorithms of constructing ASSR's and automated systems for production of experiments. The results of solving an important theoretical problem and their practical application were presented in the report "Analysis of Linear Nonstationary Systems of Experimental Research" by P. M. Chegolin and others of Minsk. The report "Some Principles of Problem Orientation of Cybernetic Equipment When Automating Scientific Experiments" by V. P. Solov'yev of Kiev reviewed questions of organizing the structures of the ASSR.

Fourteen reports were given at sessions of the section "Designing and Simulation of Systems for Automation of Experiments." These reports were devoted to development of simulation software, experience with programming simulation models in various modeling languages, and study of methods of designing ASSR's. The reports "The Modeling Complex as a Tool for Automation of Scientific Experiments" by I. V. Maksimey and A. I. Polezhayev of Gomel' and "Simulation Modeling of an Information-Measurement System Used for Experimental Processing of Objects" by Ye. P. Motalytskiy and Yu. A. Filippov of Zhukovskiy aroused animated discussion. The report "Rational Designing of Systems for Automation of Experiments Based on Parametric Models" by V. A. Vittikh, G. N. Kuklin, S. V. Smirnov, and V. A. Tsybatov of Moscow and Kuybyshev proposed a new approach to designing ASSR's.

The 37 reports at sessions of the section "Measurement-Computing Complexes" reviewed issues of aggregating computer equipment and organizing measurement-computing complexes to automate scientific experiments and the testing of technical facilities.

Fifteen reports were presented at sessions of the section "Software for Systems for Automation of Experiments." They dealt primarily with questions of the development of software for specialized ASSR's. New methods of generating ASSR software using the information data base and macro-equipment of the Unified Series (YeS) of computers were proposed in the report "The Data Base as a Model of a Subject Area for Software for Systems to Automate Experiments" by I. A. Budyachevskiy of Kuybyshev.

Thirty-six reports were heard at sessions of the section "Digital Signal Processing." They discussed methods and means of digital processing of signals and images, digital holography, and compression of data. The results presented in the reports "SKIF -- a Highly Reliable Fast Special Processor for Digital Filtration and BPF [possibly High Speed Spatial Filtration]" by R. O. Antonov, V. I. Peskov, and N. V. Cherkasskiy of L'vov and "Study of Spatial Filters Synthesized on the Computer" by M. A. Golub, S. V. Karpeyev, V. A. Soyfer, and V. P. Khotskin of Kuybyshev and Novosibirsk aroused great interest.

The reports presented at sessions of the section "Systems for the Collection of Measurement Information" were devoted to theoretical and practical issues of constructing matching devices and to actually developed collection systems. The section heard a total of 28 reports. The reports "Development of Measurement-Information Systems to Automate Strength Testing of Aviation Designs" by Sh. Yu. Ismailov, M. I. Reva, and N. F. Sysoyev of Leningrad, "System for Collection and Transmission of Tensometric Information from Rotating Aircraft Engines" by V. R. Bashirov and co-authors of Ryazan', and the summary report "Subsystems for the Collection of Measurement Information Based on Test Transfer Processes" by O. P. Skobelev of Kuybyshev were particularly notable. The last-mentioned report presented the essential features of the technique of test transfer processes and related results of its practical application in different subsystems for collection of measurement information.

Eleven reports were presented at sessions of the section "Systems for Display of Experimental Data." Theoretical and practical questions of constructing a modular trunk display system designed to perform a broad range of tasks and constructed on a contemporary element base were reviewed in the reports of A. A. Boltyanskiy, V. G. Lyubimkin, V. G. Mikhaylov, and A. N. Poruchikov (Kuybyshev).

At sessions of the section "Training of Specialists in the Field of Automation of Experimental Research" the reports "Experience with Training and Retraining Specialists in Automation of Scientific Research at the Moscow Power Institute" by G. K. Krug of Moscow, "Experience Retraining Engineers and a Model of the Specialist in Automation of Experimental Research" by B. Ye. Aksenov, Sh. Yu. Ismailov, and others of Leningrad, and "Procedures for Conducting Experimental Research at a Scientific Research Institite" by A. A. Porsev of Kazan' aroused interested debate.

The sessions of the sections recommended that the complete texts of several reports be published in the anthology "Avtomatizatisiya Eksperimental'nykh Issledovaniy" [Automation of Experimental Research].

At its final plenary session the conference adopted a resolution. It spoke of the necessity of continued work in the field of building automated systems to process data from scientific research, systems to control experiments, and systems for full-scale testing of models of new technology. The conference recommended that the efforts of specialists in the field of automation be concentrated on working out the theoretical foundations for construction of systems to automate scientific and technical experiments and working out principles of building information retrieval systems; on continued development and introduction of CAMAC methodology in systems for automation of experimental research based on organization of industrial production of devices meeting CAMAC specifications. The resolution took note of the need to organize training of specialists in particular areas of the automation of scientific research within the framework of existing specialization and also the need to open up a new specialization, called "Automation of Scientific Research and Production Testing," as quickly as possible. A decision was made to hold the 1st All-Union Congress on Automation of Scientific Research in 1981 with participation by foreign scientists.

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RAISING EFFICIENCY OF AUTOMATED MANAGEMENT SYSTEMS

Moscow AVTOMATIKA I TELEMEKHANIKA in Russian No 6, 1979 pp 21-28

[Article by Academician V. A. Trapeznikov, based on report given at All-Union Convention on Computer Technology and ASU [automated management system], organized by State Committee on Science and Technology of the USSR Council of Ministers, in May 1978]

[Text] Three qualitatively new directions of ASU developments leading to substantial enhancement of efficiency of management are discussed. They are: 1) Use of universal adaptative (self-adjusting) control systems for technological processes; 2) Automated ASU planning; and 3) Fitting ASUs with highly productive problem-oriented fourth-generation computers with uniform variable stuucture. Basic results obtained in these directions at the Institute of Management Problems are described; the main features of ASU technical policy for industrial and other facilities are noted.

In decisions of the 25th CPSU Congress and resolutions of the CPSU Central Committee, the value of questions of management, the need for intensified improvement of utilization of computer technology and increased ASU efficiency are repeatedly indicated.

Our country has had significant success in these fields, but we also know of the existence of inefficient ASUs.

Without mentioning the well-known problems, let us consider some ways of improving management systems which are revealed by modern achievements of science.

In science and technology, a slow, gradual, evolutionary development occurs as knowledge is accumulated. At the same time, within the complex ideas we can see concepts which lead toward qualitative leaps, to revolutionary development of science and technology.

Evolutionary development is inevitable and is unconditionally useful, but ways for rapid, qualitative, revolutionary development should be intensively sought, putting up onto a principally higher level. Some of these qualitatively-new ASU developmental trends are discussed in this article, based on experience of the Institute of Management Problems.

Due to limitations of space, we will specify only three of the many ideas which matured at the institute:

1) creation of universal adaptative control systems for technological processes;

2) flexible, high-speed automated planning of ASU;

3) creation of new high-productivity problem-oriented computers.

1. Universal Adaptative (Self-Adjusting) Control Systems for Technological Processes

Throughout the world qualified specialists have been studying technological processes from the standpoint of control, the properties of mathematical models of processes, and working on even more efficient control algorithms. This is a long, arduous and costly process, but it is necessary for efficient control. To facilitate the utilization of these scientific results, scientists are trying to classify control objects, and standardize models and methods of control on that basis.

It would seem that to plan a specific ASUTP it would be enough to select the appropriate scientific data from the tremendous stockpile and start planning. Unfortunately, this can not be done that often. The reason is that objects standardized on the theoretical level turn out to be different in practice and alter their characteristics in the operation process.

To deal with these factors and many other similar ones, adaptative (self--adjusting) systems have been designed. The theory of these systems have been developed for a long time at the Institute of Control Problems, which obtained fair results.

In one achievement of the institute in the field of adaptative control, awarded a State Prize, we should discuss in greater detail because we feel that this is how, with the appropriate arrangement of things, it is possible to achieve a qualitative leap in efficiency of ASUTP. This concerns a system of adaptative control with identifier in the feedback circuit (ASI)[1, 2].

The notion of the system consists in the following. An identifier in the form of a minicomputer or microcomputer, especially the PS-300 which will be discussed below, is connected to an object supplied with a set of regular sensors. Based on input and output data arriving from the object, the identifier automatically corrects independent variables of the object's mathematical model (model structure and initial approximation for parameters are given earlier). The refined equation of the object obtained in this fashion is then utilized to work out the optimum control action.

This is also a principle feature of ASI which ensures not only automated control of technological processes, but also automation of object study, construction of their mathematical models (in the sense noted above) based on changes in the object's parameters during operation.

The ASI system has two operating conditions: learning mode and control mode. In the learning mode, the system receives data about the inputs and outputs of the object, studies it and establishes the coefficients of the model. The system also predicts the description of the output product without intruding into the control process. When the predicted output characteristics conform to the actual ones, this means that the system has learned and then can be manually or automatically switched to the second mode--control mode. In this mode, the system actively influences the object and simultaneously continues to refine its description.

The system has several valuable properties. It liberates the creative and physical efforts of man, reduces the time required for planning and debugging by automatic adjustment to the required mode and because of its universality: with the known structure of the object, its physical nature does not play a role--it can be a pipe rolling machine, a chemical reactors, a convertor, etc.

Because of the ability to adjust to varying parameters of the object, the ASI can tackle one of the most complicated problems in ASUTP--control of non-stationary objects. Non-stationary objects in industry are more the rule than the exception. Indeed, large technological facilities (rolling mills, blast furnaces, oil refining facilities) do not only undergo change during operation (catalysts age, rolling mill rollers wear out, etc.), but are continually updated in accordance with the latest achievements of science and technology. This updating alters the parameters of the mathematical model of the object that must be input into the control system, and the ASI does this automatically.

It improves the quality of output production, its valuable properties have been proven in practice. ASI operating at pipe rolling mill 160 of the Pervoural'sk New Pipe Plant has raised the precision of rolling and consequently makes it possible to roll with minus tolerances: this saves about 3,000 tons of high-alloy steel per annum and savings about 1,000,000 rubles per year. Its payback time is 5-8 months. The system was put into pilot industrial operation in 1969, and since 1973 it has been in industrial operation [1]. Similar ASIs now control another three mills and are included in three planned mills. But the tempo of this work is still unsatisfactory.

ASIs have also been included in planned control systems for the process of boron production and oil refining in a large-capacity facility. The possible use of ASI is being investigated for processes of controlling flat rolling, the blast furnace process, etc. Preliminary analysis showed that ASIs should be set up a several thousand objects in various sectors of the national economy.

Significant interest in ASI has been shown by a number of foreign firms (Italy, Yugoslavia, USA) because ASIs are at an advanced world level. The institute is actively continuing research in its theory and practice.

ASI is in fact a universal, highly efficient system providing a qualitative shift in the creation of ASUTP.

Naturally, like any new idea, ASI did not immediately win everyone over and there was "psychological resistance", but the time has now come to promulgate ASI in the organization, perhaps by means of a specialized special design office.

2. Automated Planning of ASU

We know that the relative significance of planning, where this implies the entire cycle from analysis of the object to tuning up the system during operation, increases with the years and has now reached 70 percent of the total expenditures for ASU creation (about 1,000,000 persons are involved in developmnt of ASU in the United States). The growing labor-intensiveness and scope of planning of ASU, of course, becomes an obstacle to their wide utilization and calls for automated planning.

Such work is being done here and abroad (in the USA, England, West Germany, Japan, etc.). Some countries are following the path of standardization--creating standard applied programs packages, while others are using the computer to automate certain stages of the planning process (without welding them into a unified technological line).

Program standardization is certainly useful, but an evolutionary process is slowly taking place. The efficiency of standardization depends on the identity and stability of the control objects. Several identical objects certainly exist, but expenditures to coupling standardized planning decisions are often commensurate to expenditures for the original planning.

When we speak of the stability of control objects, we should note that this is where we find the principal defect of many ASU planning and utilization concepts. Most ASU must be much more dynamic than we would imagine. Control objects are modified during long-term planning and debugging and are improved and altered during operation. We know of a foreign case where a control system that the authors first called standardized underwent 3000 substantive modifications in the course of 5 years. Quite a few examples can be given where many years of planning have been followed by different requirements for the system, and by the time it was installed it had become obsolete. The inflexibility of technical and programming facilities blocks the introduction of necessary changes and statement of new problems, even more so when the user lacks qualified programmers.

Should we really be amazed that after dragged-out planning and debugging and with inflexible programs a user would lose interest in the ASU or even develop "psychological resistance"? It is the "consumer qualities" of the ASU, not just the users, that are guilty of this.

Consequently, the problem of approaching automated planning was reformulated to meeting the following requirements [3]:

a) speed of ASU planning with the simplest method of preparation of initial information, reducing cycle length to a minimum: analysis-development-programming-realization;

b) orientation to the user, giving him an opportunity to load the system with problems in order of decreasing efficiency, to modernize the system, include new problems on his own without calling in "ombudsmen" and highly qualified programmers (the do-it-yourself theory).

In conformity with these requirements, at the institute studies have begun on a promising scientific-research program entitled "Automated development of integrated control systems" (abbreviated ARIUS)[4].

A principal feature of ARIUS is the non-procedural linguistic media oriented to administrative personal [5]. The language and programming facilities of ARIUS provide an opportunity for automated synthesis of the information portion of ASU, which composes 70 to 80 percent of all the problems of modern ASU. Furthermore, it is planned to include control problems solved using decision tables, i.e., administrative decisions of the "recipe" type selected according to logical conditions, as well as the connection of programming modules for optimization problems and technological process control problems. This makes it possible to give a further boost to operating efficiency of complex industrial-technological lines because of matched conditions and characteristics of individual lines in the technological chain.

The ARIUS program provides for various aspects of integration and some other promising features, but it is still in need of more work. Studies are now being completed on the creation of a prototype ARIUS complex which would consist of "instrumental" and "operational" programming packages which are independent of the specifics of the control object.

The specifics of the object and requirements imposed on the ASU information system are reflected in the problem specifications written with the aid of personally oriented linguistic media of ARIUS [5]. A distinctive feature of these media is that they make it possible to formulate a description of problems at the functional (non-procedural) level by using a system of representations and the terminology of the object's administrative personnel.

Problem specifications can be written in parallel and independently by different people; they are processed by programs of the instrumental package which combines them into a unified system of applied information and programming software called the control text.

This control text together with the operational package programs are loaded into the user's computer and they support (in interaction with the operating system of a given computer) reception, processing and output of information in conformity with user requirements formuled as functional problems specifications, as noted above.

Problems specifications can be written using standard ARIUS punched cards or in programming dialogue with a display unit.

Later the control text and operational package are loaded into the computer portion of the user's ASU; they tackle all ASU programs by replacing regular programs written in the non-automated fashion.

We should mention that Series YeS, ASVT and other computers with Fortran translators can be used for automated planning with the aid of ARIUS.

The tendency toward development of integrated ASU is promising for sure. But the creation of an integrated system is a complex problem and ARIUS will be of definite utility.

Much remains to be done in scientific and organizational attitude. The first real advances have already been made: Minpribor switched several organizations to the program. Their composition must be expanded and it is necessary to consider setting up regional automated planning centers and perhaps, a center for time-shared ASU planning.

We should expect that automated planning based on ARIUS will produce "revolutionary" improvements in development and exploitation of ASU.

Wide utilization of automated planning will definitely free some tens of thousands of persons involved in ASU planning and debugging, sharply reduce the time required for planning and debugging, save capital investments and, what is most important, increase efficiency of control and accelerate the tempo of scientific and technical progress. We can not, of course, forget about the "psychological barrier", but it must be overcome.

3. Problem-Oriented Control-Computing Complexes with Uniform Variable Structure of the PS type (Computers not designed to replace traditional computers (series YeS, SM etc.)

Requirements for technical and economic characteristics of computers are continually increasing.

The Institute of Control Problems back in the 1960's promoted original principles of computer design and on that basis posed this problem: by using the simplest and widely assimilated technology of bilateral printer arrays and medium-speed TTL IC's, to design a computer having high technological indicators. This scheme underlay a family of multiprocessor computers of type PS with uniform variable structure [6].

We know that specialized computers are faster than all-purpose ones: each specialized computer tackles its own narrow class of problems. But this causes an extreme diversity of computer types. Thus principles were developed for dynamic adjustment of computer structure for the problem being solved in each particular instant and it was thus possible to combine many specialized computers into one problem-oriented computer. Time expenditures for adjustment of the computer medium can be reduced by using vectored instructions such as the Fourier transformation, correlation analysis, filtration, etc. Then at a particular moment the computer becomes a narrowly specialized, efficient machine.

Furthermore, in the traditional computer structure, each operation is associated with memory access which essentially limits computer speed. In this case, however, the number of memory accesses is sharply reduced by means of distributed memory and direct signal copies simultaneously at different points in the decision field.

Finally, PS computers have deparallelization in four levels of the hierarchy [7]. Deparallelization is possible for 70 to 80 percent of all algorithms. When working with high level languages in PS computers, deparallelization is accomplished automatically by a special unit in the translator without the programmer's intervention.

The PS family now includes five models in various stages of completion, from the small computer PS-300 designed for controlling technological installations, to the associative learning computer which can tackle optimization problems of large size several orders faster than existing third-generation computers.

Type PS computers can solve problems which have been unsolvable or poorly handled in traditional computers, such as the problem of real-time processing of large aerial photographs, problems whose solution relies significantly on man, who makes a decision based on his experience in terms of unknown laws and algorithms--problems which are hard to formulate.

The newer type PS computer can be used as a built-in computer in devices requiring substantial mathematical data processing (e.g., various chemical analyzers) or directly in controlled equipment.

Based on the new model PS-300 computer, which is already in serial production, the UVK PS control-computing complex has been designed. The complex includes a computer, communications device and control panel. It assures efficient adaptation to user problems via rapid structural readjustment, the presence of enlarged problem-oriented instructions and adaptative applied program packages. The use of the complex makes it possible to switch from centralized ASUTP to more promising decentralized (or distributed) control systems for technological processes in the chemical, metallurgical and other sectors of industry and thereby increase efficiency of ASUTP.

The next model of the PS complex contains 8 to 64 processors and has productivity of about 25,000,000 short operations (adding type) per second, is about the size of a single standard frame (eight-processor version) and about 200,000,000 short operations per second with five frames (64-processor version). Core storage with five frames is about one megabyte.

Based on the type PS computer, at the Institute of Control Problems a geophysics computing complex has been developed for processing data of seismic prospecting to locate deposits of petroleum, gas and other minerals, as well as to predict earthquakes. The complex uses standard I/O devices.

With their identical cost, type PS computers will have ten times faster speed (according to problem type); if we compare their costs, then at equal productivity PS computers would be 1/50 to 1/100 of the cost of traditional computers.

From now on, when microcircuits with larger scale integration are used (on the order of 10,000 components), a computer with productivity of about 500,000,000 operations/second will be housed in a single frame.

The scientific interests of institute scientists is not limited to the boundaries of the three trends named above. The institute is elaborating theoretical foundations of control of complicated engineering and technical complexes, management of groups, organizations and communities, control of medical and biological objects. Methods and principles of design of information assemblers and processors in control systems are being developed, including computing systems, elements and devices of automation. In all these trends there have been new, promising ideas. They have been reflected in other articles of this issue of the journal and thus need not be discussed here in greater detail.

Studies of the institute have promoted the substantial growth of the scientific and technical potential of the country in the field of control, not to mention the tremendous economic effect gained from their introduction into the national economy (we calculate savings of 115,000,000 rubles in the 9th Five-Year Plan, apparently reaching 200,000,000 rubles in the 10th).

We have focused only on the three effective trends whose distinction is the qualitative leap forward in terms of assimilated technology. The qualitative leap forward, of course, was impossible without scientific foresight and risk. If we really want to raise ASU efficiency, we must focus our attention on points of qualitative growth.

Conclusion

We will state the basic assumptions which we feel should be guidelines in determining a strategy in ASU for industrial and other facilities.

1. Enterprise management systems must be more dynamic than is usually done in planning ASU, or else ASU can turn from a progressive factor into a conservative factor of management. To avoid this, a second loop must be introduced in the form of automated planning systems for dynamic ASU which can be readjusted during operation. Considering the scientific projects begun on automated planning at the Institute of Control Problems and other institutes, we should note, plan well and arrange the work program to design ASU automated planning systems. Scientific preparation of such a program was begun by the USSR National Committee on Automated Control (NKAU SSSR). The results will be presented to the USSR Academy of Sciences, Minpribor, GKNT and other interested agencies.

2. Automated control systems for technological processes can be standardized on the programming and algorithmic level based on adaptative methods developed at the Institute of Control Problems and mainly on the basis of ASI. This approach has been tested in practice, was highly efficient and can be recommended as a basic direction of technical policy in ASUTP.

3. When we talk of type PS computers, we should stress their enormous promise in several fields. An element base must be specified and the maximum possible industrial capacities must be mobilized for their manufacture.

4. There is a great danger of diluting efforts when too many problems are being tackled. They should be purposefully concentrated in a small number of directions after focusing attention to three trends discussed above, because these cause qualitative growth in ASU efficiency. These trends will pay back 50-100 rubles for each one spent.

We made a conscious effort to avoid discussing organizational problems of implementing our proposals; they are beyond the scope of this particular article, which was aimed at presenting some fundamental ideas which we feel show the possibility of increasing the quality level of efficiency of automated control systems.

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EXHIBIT OF INTEGRATED TESTING/MONITORING ELECTRONIC COMPLEX

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[Article by S. B. Abramov, candidate in economic sciences: "Integrated System of High Efficiency and High Quality of Operations"]

[Text] The industrial thematic exhibit "Integrated System of High Efficiency and High Quality of Operations" was held in the "Computer" pavilion at the Exhibition of Achievements of the USSR National Economy in Oct-Dec 1978. Among the displays at the exhibit, specialists' attention was drawn to an automated system for monitoring and diagnostics of circuit boards in integrated-circuit-based computers, equipment for automated monitoring of assembly quality, a stand for programmed monitoring of model replacement elements, a semiautomatic switching unit for the integrated circuit meter (IIS-1), a "Minsk-95" unit for recording primary information and a YeS-8504 subscriber station. Some of these exhibits are described in brief in this article.

The automated system for monitoring and diagnostics of circuit boards in integrated-circuit-based computers (ASK) is intended for functional monitoring and diagnostics of large-scale integrated circuits and mounted logic components with integrated circuits. Included in the ASK is a specialized processor, an operational memory (two units), an interfacer (15 units), a portable console from the "Consul-254" machine (15 units), a test monitoring unit, an FS-1501 photoreader, a PL-80 punch, an MPU-16-2 printer, a YeS-5050 replacement magnetic disk memory (NSMD) and a punched tape "Brest" data preparation unit. The base designs of the models at all levels were developed from base designs of the Unified System of Computers.

The specialized processor of the monitoring system services portable consoles, verifying 16 or more products with time-sharing. The portable consoles have replaceable adjustable blocks for matching by levels and operating speeds with a system of elements on which the corresponding product is realized.

The software of the ASK consists of operating programs: control, monitoring of the functioning of system components and monitoring and diagnostics of the products under verification. Monitoring and diagnostics are carried automatically with monitored tests. The test structure makes allowance for the requirements of the industry standard "Automatic Monitoring of Digital Components." A library of test routines for monitoring and diagnostics is located in the replaceable magnetic disk memory. Entering information on the monitored product, its verification mode and the outputting of monitoring results are done with the 'Consul-254' machine.

Specifications of ASK

Operating speed (number of commands), per second	20,000
Size of main memory, in kilobytes	32
Size of external memory, in Mbytes	7.25x4
Signals to verified product, in volts:	
"0"	+(0.2÷0.8)
"1"	+(2÷3)
Signals from verified product, in volts:	
"0" not more than	+0.33
"1" not less than	+2.4
Number of input/outputs of verified product	Up to 300
Line voltage, in volts	380, 220 (50 Hz)
Power required, in kW	12
Area occupied, in meter^2	100

The Poisk-3 unit for automated monitoring of assembly quality is intended for automatic verification of the execution of assembly interconnections and is used when verifying printed circuit-boards and products of radio-electronic equipment and computers with volume installation for external connection to the verified points (to plug contacts, pads or openings for desoldering components, microcircuits, and so on).

Included in the unit is a control panel, a switching block (up to 32 parts), an FS-1501 photoreader, an MPU-16-2 printer and a PL-80 punch. The switching blocks can be installed one on the other. The products verified are connected to the switching blocks with braided connectors; the printed circuit-boards are installed in the contact unit.

The unit monitors the presence of necessary and the absence of extra connections between the points of the products under verification. Correctness of interconnections is checked without quantitative estimate of the electrical circuit parameters in a response reaction to test action in the form of a DC voltage level. With the unit products are verified by comparison with a reference standard punched tape, accompanied by printout of all improperly assembled circuits, with an indication of the nature of the errors; manufacture of the reference standard punched tape by connection of the nondefective product; and printing out of all the connections in the connected product. Several products can be connected to the unit, but only one is checked at each moment.

Specifications of Poisk-3 unit

Number of points of product verified for a single switching block, not more than	2048
Maximum product verification time in minutes, with indicated number of points:	
2,000	Approx 0.6
20,000	5
60,000	15
Line voltage, in volts	380,220 (50 Hz)
Power required, in volt·amperes	550,800

The stand for programmed monitoring of model replacement elements automatically checks the functioning of components under a program that is kept sorted in the replaceable code matrix (256x144 bits), by comparing in the input signals with the reference standard signals. At the beginning of any matrix a program for self-monitoring of the stand performance is interwoven, and with special braided connectors the product under verification is connected to it.

The number of the verification microprogram is selected by a selector switch. Mounted on the stand panel are indicators of the address of the microprogram number and the logic levels of the signals. The stand for programmed monitoring of model replacement elements containing series 217 microcircuits is verified at 300 kHz with line voltages of +3 and +6 V and with input signal levels of +0.3 and +2.7 V.

The switchable semiautomatic unit for the IIS-1 is intended for connecting the leads of the test microcircuits to a meter and consists of a support with two wells for accommodating microcircuits, in which--with relay contacts--one of them is connected to the IIS-1. The switchable unit is placed on the working table of the meter and is connected to it with plugs; in this way the productivity of the IIS-1 is raised by 1.6-1.8 times.

The "Minsk-95" unit for recording primary information (URPI) is designed for acquisition and recording of information in an automated management system. This is a consolidated unit, consisting of a digital block of conditionally constant characters, a control panel, an alphanumeric printer based on the Consul-254 machine, a block for converter "Consul-254" code into punched tape code (GOST 10859-68) and for the inverse conversion, a PL-80 punch, electronics block and power supply. The unit operates in the following modes:

1. Recording primary information automatically read from the block of conditionally constant characters and punched cards or from the keyboard of a "Consul-254" machine. Information is outputted on punched tape and blank forms. The read and acquired information is monitored by verifying the symbols for odd parity with simultaneous formation of the control symbol of the acquired block.

2. Automatic printing out of information contained on punched tape and on blank forms.

3. Repunching and monitoring of punched tape. Each symbol in these modes is verified for odd parity and each information block--for matching of the check symbol read from the punched tape with the check symbol formed in the unit.

Specifications of "Minsk-95" unit for recording primary information

Number of characters entered	97
Printing rate of punched tape, in characters/s	8-10
Rate of repunching punched tape, in lines/s	25
Line voltage, in volts	380, 220 (50 Hz)
Power required, in kV·A, not more than	0.9
Overall dimensions, in mm	1250x765x720

The YeS-8504 (AP-4) subscriber station is intended for acquiring information and sending it to input/output devices, interchanging information with the computer complex and processing information under a given algorithm. The AP-4 station is a banked terminal system with programmed control, used in the modes of information preparation and autonomous processing and interchanging of information over communication lines. Included in the AP-4 unit are the AP-2100 central unit, the IA-001 (YeS-8010) stand, an AP-5080 magnetic tape block, an AP-6100 unit for inputting information from punched cards, an AP-7190 punched tape unit, AP-7102 and AP-7104 printers and an AP-7060 unit for information input/output on a cathode ray tube. The composition and number of the input/output devices differ in relation to the station modification (see Table). The input/output devices are placed 500 m from the AP-2100 unit.

Modification number	Number of devices in modifications				
	AP-5080	AP-6100	AP-7190	AP-7102	AP-7104
YeS-8504	1	--	--	--	1
YeS-8504-01	2	1	1	1	3
YeS-8504-02	2	--	1	--	5
YeS-8504-03	2	--	1	1	4
YeS-8504-04	1	--	1	2	4

Combined operation of the subscriber stations with the Unified System computer models is achieved through the YeS-8402 or YeS-8400 data transmission multiplexer and is controlled by the computer in the operating system, version 4.1 and subsequent versions.

In the data teleprocessing system of the Unified System of Computers the AP-4 operates in the semiduplexing mode over dedicated telephone channels with quadrupole termination in the slave mode with the synchronous method of data transmission using symbolic synchronization.

In the mode of operational interchange of information of input/output devices with the computer, the subscriber software ensures the independent operation of all the input/output devices; in the mode of operational data preparation --preparation of a packet of messages simultaneously at all input/output devices; transmission of this packet of messages is effected to the computer at specific moments. Included in the subscriber station software are the operating system, the libraries of processing and utility routines and the maintenance routines. The operating system consists of a complex of control routines (dispatcher, interchange with the input/output devices and the computer, control of data flow and interfacing with the subscriber station operator) and a set of general program modules.

The complex of processing routines is a minimum set of software necessary for processing data and for their control. Considering the specific features of the application, users can add to the composition of the processing routines. For user convenience, the software includes a set of utility routines operating without the operating system. The maintenance routines contain verifying and diagnostic tests intended for monitoring the performance of the input/output devices, the central equipment and the subscriber station as a whole, and also functions without the operating system.

Specifications of the AP-4 unit

Method of control	Programmed
Representation of commands	Relative
Data format	Eight-place binary numbers and alphanumeric fields
Mean rate of executing operations with binary numbers, in operations/s	50,000
Capacity of main memory, in kilobytes	32
Data transmission rate in communication channel, in bits/s	2400, 1200
Rate of data interchange with input/output devices, in kilobytes/s:	
in multiplexing mode	20
in monopole mode	50
Number of commands carried out	47
Line voltage, in volts	380, 220 (50 Hz)
Power required, in kV·A	3-6
Area occupied with the minimum number of input/output devices, in meter^2	65

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COMPUTER SEMINARS

Moscow VESTNIK AKADEMII NAUK SSSR in Russian No 9, 1979 p 141

[Excerpt] "Homogeneous Computer Structures and Minicomputers." Zvenigorod, Moscow oblast', December, three days. (Institute of Control Problems; USSR National Committee on Automation Control).

"Synthesis of Control Devices based on Microprocessors and Homogeneous Environments." Second seminar. Moscow, December, three days. (Institute of Problems of Information Transmission; USSR Academy of Sciences Scientific Council on the Complex Problem of Cybernetics; Scientific-Technical Society of Radio Engineering, Electronics and Communications).

[53]

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SECOND ALL-UNION CONFERENCE ON ANALOG-TO-DIGITAL CONVERSION

Moscow PRIBORY I SISTEMY UPRAVLENIYA in Russian No 6, 1979 p 46

[Article by V. P. Safronov, candidate in technical sciences: "Second All-Union Conference "Methods and Equipment in Analog-to-Digital Conversion of Parameters of Electrical Signals and Circuits"]

[Text] In Sep 78 the city of Penza was the scene of the All-Union Conference on urgent problems in expanding equipment in analog-to-digital conversion, including, problems of the theory and designing of analog-to-digital converters (ATsP), new principles and methods of constructing and improving the main characteristics of ATsP and problems of using microprocessors in designing and building multifunctional ATsP and the ATsP for high-speed processes. Also discussed were problems on the methods and equipment for investigating and monitoring the metrological characteristics of equipment of digital electrical measuring technology.

The conference was organized by the Scientific-Technical Society of the Instrument Making Industry imeni Academician S. I. Vavilov, the Scientific Council on Problems of Electrical Measurements and Information and Measuring Systems of the USSR Academy of Sciences, the Ministry of Instrument Making, Automation Equipment and Control Systems, the RSFSR Ministry of Higher and Specialized Secondary Education and the Penza House of Scientific-Technical Propaganda.

Participating in the conference were 310 specialists from 153 organizations in 65 cities in our country. Seventy papers and reports were delivered.

After Doctor in technical sciences V. M. Shlyandin, chairman of the organizing committee, gave the opening address, characterizing the goals and tasks of the conference, papers were read dealing with urgent directions in expanding equipment in analog-to-digital conversion, "Status and Prospects of Development of Equipment in Analog-to-Conversion in Electronic Instrument Making," by N. I. Gorelikov (Moscow), E. I. Tsvetkov and Yu. A. Nechayev (Leningrad), "Systems Analog-to-Digital Converters," by E. I. Gitis and V. V. Vlasova (Moscow) and "Tasks of Metrological Support of Digital Measuring Facilities with Digital Computers," by Sh. Yu. Ismailov and B. M. Pavlov (Leningrad).

A large part of the papers were about problems of further improvement in integrating ATsP and an expansion in their scope of use. E. K. Shakov (Penza) delivered a paper, "Problems of Theory and New Principles of Constructing Integrating Scanning Converters." It generalized the results of investigations in this direction. A paper by V. S. Gutnikov (Leningrad), "Use of Power Weighting Functions (SVF) for Improving Noise Suppression in Integrating Analog-to-Digital Conversion," analyzed the properties of promising power weighting functions, which can be simply realized in the construction of integrating instruments. The method of weighted treatment of measurements as a new and promising direction of boosting measurement accuracy strongly attracted specialists' interest at the conference. The method can boost the accuracy of digital integrating converters and analog-to-digital converters in measuring frequency, phase differences and integrated signal parameters. Improvements in the metrological characteristics and extension of the functional capabilities of digital voltmeters by using microprocessors was the subject of two papers--"Integrating Digital Voltmeter Based on Microprocessor" by A. B. Seliber et al (Leningrad) and "Method of Measuring Parameters of Electrical Circuits with Microprocessors" by L. I. Volgin (Ul'yanovsk) and others.

Conference participants listened to and discussed with high interest addresses on problems of increasing operating speed and the dynamic accuracy of analog-to-digital converters. V. P. Shevchenko and V. P. Safronov (Penza) presented an analysis of the status of developments of high-speed servo analog-to-digital converters and their multifunctional use. A new method of analog-to-digital conversion of high-speed processes was highlighted in a paper by G.I. Gotlib and V. Ya. Zagurskiy, "Sporadic Scanning Analog-to-Digital Converter."

A new direction that takes into account the level of current microelectronics and circuitry in building high-speed and ultra-high-speed analog-to-digital converters was presented in a paper by V. P. Safronov and Yu. V. Polubabkin (Penza). The authors examined questions of building the analog-to-digital converters by using analog devices with conversion functions in the form of a multiply broken line that compresses the amplitude range of the input signal (so-called signal enveloping devices).

Much attention at the conference went to problems of metrological support, monitoring and investigation of the metrological characteristics of analog-to-digital converters and digital-to-analog converters. Two papers were about developing algorithms and the experimental investigation of random errors by the auxiliary noise method. The paper by V. Yu. Konchalovskiy et al (Moscow) discussed a new method of investigating errors over a range that permits a significantly reduction in the testing volume through use of a computer for calculating the errors at all points on the scale.

Strong interest was stirred by G. Kh. Mikhaylov's report on the development of precision calibrators and equipment for investigating and monitoring the metrological characteristics of analog-to-digital converters and their components. These calibrators and equipment are unparalleled as to breadth of functional capabilities in domestic or foreign practice. And the nonlinearity and instability after 8 h of operation was one ten-thousandth of a percent. No less interesting was a paper by R. E. Kapiyev (Leningrad) on the development of a class 0.002/0.001 digital voltmeter, intended for the building of automated systems for monitoring and certifying digital measuring equipment.

The conference participants noted that in recent years there have been large changes in the resolution of these problems. Major theoretical and experimental investigations were conducted; they served as the basis for developing and mastering in series production new digital electrical measuring instruments and analog-to-digital converters.

Nonetheless it was noted that considerable efforts by personnel in science and engineering are needed to resolve most of the problems discussed at the conference. They include, primarily, the following: higher accuracy, operating speed and noise immunity of analog-to-digital converters, especially for converting low-level electrical quantities, by using new methods, algorithms and structures, autocorrection of errors, and self-adjustment, microprocessors and a modern component base; mastering of the series production of metrological equipment for investigating and monitoring the metrological characteristics of digital electrical measuring instruments; developing methods and equipment for the direct conversion of parameters of complex electrical circuits into standardized electrical signals; and developing and applying methods of integrating scanning conversion for dynamic measurements and measurements of integrated parameters of AC signals.

The conference decided that the following action was necessary: to request the All-Union "Soyuzelektropribor" of the USSR Ministry of Instrument Making, Automation Equipment and Control Systems to examine the proposals of the conference for the possible inclusion of the most urgent directions in the subject-matter operating plan of the subindustry.

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B. Organizations

40TH ANNIVERSARY OF THE INSTITUTE OF MANAGEMENT PROBLEMS

Moscow AVTOMATIKA I TELEMEKHANIKA in Russian No 6, 1979 pp 5-20

[Article by Unknown author on 40th anniversary of the Institute of Management Problems]

[Text] The Great October Revolution opened a new era in the development of science and culture in our country. Systematic development began in science, the use of its achievements and results in the rapidly developing national economy.

The Communist Party and the Soviet government view scientific and technical progress as a necessary condition of socialist transformation. Achievements in theory and practice of management are part of the overall scientific and technical progress of the Soviet Union.

Soviet scientists and specialists, while developing the noted traditions of outstanding domestic scientists and engineers--I. I. Polzunov, I. A. Vyshnegradskiy, N. Ye. Zhukovskiy, A. M. Lyapunov and others--made a great contribution to the development of management problems.

In the 1930's, the development of industrialization of our country advanced the need to tackle problems of automated management in several leading sectors of technology, such as electronics, metallurgy, thermal technology, etc. In industry, transportation, communications, in developing energy systems, in defense facilities, there were problems in automation, remote control and telemechanics. Groups of specialists working on problems of automated management, automation and telemechanics were established at leading sector scientific-research organizations.

This is when it became necessary to set up a science center combining the talents of leading scientists in automated management, automation, telemechanics, a center designed for coordination, generalization and further advancement in the development of management problems.

In 1934, the Presidium of the USSR Academy of Sciences formed a Commission on Telemechanics and Automation--the first specialized organization in automated management. In 1936 the journal "Avtomekhanika i Telemekhanika" was founded, the first periodicial in the world dealing with automation. In 1938, the

Commission became the Committee on Telemechanics and Automation, on the basis of which was established the Institute of Automation and Telemechanics upon the initiative of acacemician V. S. Kulebakin in 1939. V. S. Kulebakin--a scientist known for his work in electrical technology and avionics--was appointed its first director. A great deal of important work was then being done in the country in specific fields of automation, but the institute became, and remained for many years, the only specialized scientific institution doing fundamental research in management theory.

By the time the institute was formed, scientific organizations already had two vaguely defined and partially intersecting trends--the theory of automated control and the theory of principles of construction of technical means of automation and telemechanics. Further development of these initial trends was associated with complication of facilities and tasks of management, with transition from management of separate technical facilities to comprehensive management, and also with establishment, evolution and popular utilization of computer technology in management tasks.

As the ideas of management of technical facilities penetrated into the sphere of management of facilities, including people and groups of people, from 1950 through 1970 a third trend was born in the institute's activities--the theory and practice of management of organizational systems.

This trend combined work in automation of organizational management--planning, economics, construction of automated management systems of various classes, as well as work on creation of mathematical devices adequate to the tasks.

In view of this trend, even more attention began to be paid to the role of man as a link in the management chain. The stockpile of management principles started to include principles drawn up from analysis of objects in living nature. Ideas and methods of management received application in medicine. A fourth trend of institute activity thus appeared: study of processes of control in biology and medicine.

Thus the foundation of scientific problems of the institute now comprises four trends:

theory of management of complex engineering and technical complexes;
means and methods of collection and processing of information;
management of groups and communities;
control in biology and medicine.

These trends comprise the basis of scientific problems of the institute.

1. Theory of Management of Complex Engineering and Technical Complexes

Creation of foundations of the theory of management of complex engineering and technical complexes (henceforth called "management theory") is one of the outstanding achievements of the institute throughout its entire history. Work done at the institute on management theory played an important role in evolving this field of science in the last 4 decades and is held in high esteem around the world.

The 40 -year period of evolution of management theory at the institute can be broken down into three stages:

- the pre-war years, when the scientific school of automated management theory began to assemble;

- the first post-war decade—years of high institute activities in automated control theory;

- the 1960-1970's, typified by the evolution of a broad spectrum of new ideas, leading to the appearance of theory and development of methods of management of complex systems.

From the very first, a group of several scientists worked together at the institute on automated control; V. S. Kulebakin, V. S. Lossiyevskiy and G.V. Shchipanov. Without a doubt, an outstanding role in the formation of this group was played by the arrival of one of the major Soviet mathematicians, academician N. N. Luzin, at the institute in its very first years.

In the 1930's, specialists in theory and practice of automated control had an idea of the communality of processes of control in various branches of technology. However, almost all work in control theory had was then being done in the country was linked with specific fields—with control of steam turbines, electrical machinery, boiler facilities, etc., and specialists in the various fields of technology, while knowing their own range of topics, found it difficult to comprehend each other.

The book written by V. L. Lossiyevskiy (Avtomaticheskiye regulyatory [Automatic Regulators], Oborongiz, 1944)--delayed by the war years and only published at the very end of the war—was the first in our literature to demonstrate the similarity of problems and ideas of automated control, showing how important it was to reject the details of narrow technical problems of control and to try and look at things more broadly. However, even in the treatment by the book's author and his earlier work on control of specific devices, consideration rarely went beyond an ordinary statement of the problems of analysis of the given system.

At the time, G. V. Shchipanov apparently posed a question not of analysis, but of synthesis of control systems. In his interpretation, the problem of control consisted of giving the system as a whole some "insensitivity" to external disturbances, without their direct measurement. This approach was later called invariance and became the topic of a thorough investigation, but back then it was unusual.

Shchipanov's conditions of invariance applied to ordinary linear single-circuits studied at the time. They led to conditions which, from the viewpoint of engineering, were paradoxical. This paradox, on conjunction with the polemic acuity of presentation, made Shchipanov's work the subject of keen scientific debate in the press, at many seminars and at sessions of the special comission set up by the USSR Academy of Sciences. The decisions of this commission were later reviewed and the Presidium of the USSR Academy of Sciences, in its resolution dated 12 Feb 60, approved the summary of the new commission recognizing the value of the idea proposed by Shchipanov: it noted the invalidity of some assumptions and the presence of certain inaccuracies in his article. In 1967, Shchipanov's idea was recognized as a discovery with priority dating from 1939.

During the same pre-war years, V. S.Kulebakin had advanced ideas on indirect assessment of the quality of control by a "control area" and the choice of regulator coefficients based on the desired values of the roots of the characteristic equations, i.e., in terms of the essence of the problem of partial synthesis of control systems.

Discussion of the work of Shchipanov furthered the development of his ideas in the theory of invariance. A great role was played here by academician N. N. Luzin, founder of the Moscow mathematics school. His work on the mathematical theory of invariant systems was then used as a model for employing the mathematical apparatus in tackling problems arising in control theory.

The first All-Union Convention on Automated Control was convened in 1940. It was comparatively small, bringing together less than 100 participants; it was the first to combine the talents of people belonging to different trends of control theory. The convention mainly attracted young participants, many of which were later destined to lay the groundwork for control theory in domestic science.

The war separated those who had begun to congregate at the institute in the years before the war. During the war, coworkers at the institute were busy with work to aid the front, and the development of control theory lay idle due to the lack of effort and time. In 1944-1945 began the return of soldiers, and old ties were renwed and new contacts were made: the second period of activity of the institute had begun. Work on theory of invariant systems was also started anew. V. S. Kulebakin found a class of actual dynamic systems (measuring bridges with complex resistors) in which the conditions of invariance were satisfied. A principle of two-channelness was proposed which was a fundamental product of the theory of physically-realized invariant systems; hybrid systems, principles of selective invariance, etc. were also proposed.

An important event in this period was the arrival of A. A. Andronov, professor at Gorky State University and later an academician, at the institute. A young group of scientists began to gather around him. The Andronov seminar was started: it was destined to make substantial contributions to automated control theory, not only in our country, but abroad as well.

At the seminar were widely outlined the frequency methods of analysis of control system stability, evaluation of transient processes in them and, on that basis, general methods of analysis and synthesis of linear systems. In addition to this approach, seminar participants developed another set of ideas which was later called "the method of root hodographs": it was related to various methods of evaluation of transitional processes according to the placement of zeros and poles of the transmission function.

Much attention was given at the time to structural approaches in control theory. The matrix and operator method of presentation and transformation of structural schemata were developed, and the general properties of the class of systems specified in terms of structural features was studied.

Although the creation of linear theory was central to the work done in those years, much attention was also given to solving non-linear problems of automated control, especially using the Andronov methods of phase space, method of point display, methods of study of stability "in toto" and "in whole", and absolute stability using Lyapunov's direct method, approximate methods of analysis of self-excited vibrations in automated control systems.

Special note should be made of the interest aroused in discrete systems, typical of the first post-war decade of the institute and the Andronov seminar. In the depths of this seminar was born an idea about the discrete Laplace transformation and work was gradually begun to design methods of analysis and synthesis of discrete systems similar to those used for continuous systems, and to identify the properties and aspects of discrete systems.

During the war and in the first years thereafter, the foundations were lain for statistical theory of automated systems. Starting in the 1950's, the institute also saw intensive work done in the development of statistical theory of control processes.

The theory of optimum control was born in the second period and received its development at that time. A. A. Fel'dbaum played a great role in this field.

At the Institute of Mathematics of the USSR Academy of Sciences during these years, academician L. S. Pontryagin and his students formulated and proved the principle of the maximum, which even now forms the foundation of the theory of optimum control. At the institute, Pontryagin's principle of the maximum was promulgated into discrete systems and systems with distributed parameters. Important results were achieved in statistical methods of optimization for arbitrary loss functions. The theory of dual control of A. A. Fel'dbaum was born and developed. A. M. Letovoy and other scientists developed the method of analytical design of optimum regulators by combining the variation principle and Lyapunov's direct method.

In the first post-war years, there appeared the first monographs on the theory of automated control, the first textbooks, and the first courses in automated control theory were starting to be drawn up at technical schools and universities.

The third period of development of control theory at the institute encompasses the 1960s and 1970s. In these years, the trends noted above continued to develop--methods of analysis and synthesis of linear and non-linear systems, structural methods, theory of invariance, etc. The theory of systems with variable structure appeared, on whose basis underlay the use of sliding conditions in discontinuous systems for improvement of control processes.

During the second period, the thrust was mainly aimed at problems of control in the deterministic statement, whereas the third period was linked with the wide development of statistical methods. It was during these years that the institute saw the foundations laid for structural theory of stochastic systems, methods of data processing in complex stochastic systems were developed, as were methods of evaluation of their states and variables and methods of construction of stochastic models for identification of complex systems. This also gave birth to new trends--general theory of identification of control objects having important applications in industry, teaching theory, self-instruction and adaptation of automated systems.

Further development of theory of learning systems at the institute was tied to the elaboration of methods and theory of pattern recognition. Methods of "generalized portraits", potential functions, stochastic approximation, Bayes' approach and other methods were proposed by institute scientists to tackle problems of pattern recognitions; the foundations were laid for using principles of learning and self-adjustment in control problems. In these years, much attention was given to non-retrieving adaptative or self-aligning systems of various types. Non-retrieving adaptative systems with reference models and adaptative systems with test signals were studied. Substantial development was experienced by general theory of adaptative systems, from general assumptions encompassing problems of recognition, classification, filtration and control.

Several theoretical trends were developed that encompassed classes of systems with substantial specification of objects and targets of control. Research was done on problems of stabilization, controllability, identification and optimization of systems with distributed parameters. Theories of multiple-connection control systems and methods of their optimization were developed. Foundations of the theory of systems of terminal control were created; principles of construction and methods of synthesis were developed for such systems. In view of the development of control systems for large technical complexes, work on analysis of reliability and efficiency of complex systems was expanded. Analytical methods were designed, as were methods of statistical simulation of reliability characteristics of such systems.

The theory of relay devices and finite automatons, structural and abstract, held a special place at the institute and was substantially evolved in theoretical studies. The first research in this field dates back to 1940, and a systematic construction of foundations of the theory of relay devices occurred in the 1950's. Research was initially limited to applications of logic algebra to the theory of relay devices. Later on, in the 1960's and 1970's, methods of "block" synthesis of relay devices were elaborated on the computer. Relay device theory and finite automaton theory laid the mathematical foundation for the theory of planning of many complex machines, including computers.

The theoretical results of the institute have been widely utilized to design control systems for technical facilities in the most varied sectors of the national economy.

The institute group contributed to the development of control problems, assuring the successful performance of work associated with assimilation and peaceful use of space: with the launch of the world's first artificial Earth satellite, the first flight of man into space, the first soft landing of an automated lander on the Moon, the Soviet-American test flight of Apollo-Soyuz, the flights of the orbital space stations "Salyut" and the "Soyuz" vehicles, the flights of international aerospace missions in the "Interkosmos" program etc.

The institute took direct part in introducing its results at all stages of design of a control system for modern ice-breakers and large-capacity ships, control systems in metallurgy, metal working, petroleum-extracting, and oil refining industry, in production of building materials, in chemical production, etc. In cooperation with industrial organizations, highly efficient systems of terminal control were designed and introduced into the national economy. New structures of adaptative systems were created, including non-retrieving ones, to control objects having a wide range of change of parameters. Some types of adaptative systems have been put into production; high characteristics have been demonstrated by systems with an identifier in the feedback circuit. Based on the results of the theory of invariance, control systems have been designed for complex industrial facilities such as high-output oil-refining production.

The size of this article does not even allow us to list all the fields in which the institute's work in control theory have been utilized and have yielded substantial savings. The wide introduction into practice of the institute's theoretical work is the base proof of the efficiency and importance of this work.

II. Methods and Means of Collection and Processing of Information

Intensive work of the institute in methods and means of collection and processing of information in control systems began during World War II when an acute need arose to establish a reference science center as a necessary link to control the mine hazard in the maritime fleet. This center was organized at the institute under the supervision of B. S. Sotskov, later to become a corresponding-member of the USSR Academy of Sciences.

From 1942 through 1944, a thorough investigation was made of various types of enemy mines; calculations and research were made of magnetic mine sweepers, and the dynamics of reaction of magnetic sensing units in mine sweeping of non-contact mines by aircraft mine sweepers. This work was of great practical value.

In addition, theoretical and experimental methods developed at that time to study systems of the reactive organs and sensing units permitted research and development to be conducted on a scientific basis and formed the start of theoretical generalizations in this field.

After the end of the war, methods and apparatus designed were used to put an end to dangerously explosive objects, to find local anomalies in the magnetic and electromagnetic field, and have yet to lose their value.

Under the leadership of B. S. Sotskov, automation elements and devices were systemized, theory and methods of calculation of a wide class of elements were developed: contact, electromagnetic and chemotronic types.

Analysis of promising ways to develop domestic instrument construction led to the institute's promotion of the modular principle of construction of instrument systems, i.e., the proposal to construct and manufacture not separate, specialized devices for monitoring and control, but instrument systems with matched input-output parameters, convenient for assembly in any of the ever more complex schemata of automated production. This idea became central to all the basic work of the institute in automation hardware, and later went beyond the scope of the institute, underlying the organization of the State System of Devices and Hardware for Automation (GSP). B. S. Sotskov's active effort was crucial in establishing this system.

At the institute, the notion of modular construction led the way in the design of pneumohydraulic device systems, magnetic devices, initial data collection systems (measuring devices), etc.

The first field where the modular principle of construction was successfully implemented was pneumoautomation. In the 1950's, in cooperation with the Scientific-Research Institute of Thermal Instrumentation and the Tizpribor [Precise Measuring Devices Plant], the institute designed a unified modular device system for pneumoautomation, the AUS, which soon supplanted devices constructed on the base principle and those containing type "04" pneumatic regulators. From then until today, the evolution of pneumatic automation devices has been attended by increasingly deeper penetration of the modular principle into pneumoautomation. A major landmark along the way was the development of the so-called universal systems of components of industrial pneumoautomation (USEPPA) in the early 1960's. This system employs the modular principle on a basic level.

In the early 1970's, the idea of modular construction was furthered by the design of the "Tsikl" [cycle] devices, where modularization construction was done at the level of subblocks and constructives, not only on the element level. The institute scientists performed all this work in collaboration with the Tizpribor Plant and this long-lived collaboration came to fruition: starting in the 1960's, USEPPA formed the basis for domestic pneumatic instrument construction. In the same period at the institute, in developing the modular principle of instrument construction, they promoted the idea of using the direct jet effect in pneumoautomation devices. Intensive elaboration of this idea, both in the USSR and abroad, let to the establishment of a new section of instrument construction--so-called jet technology or pneumonics.

Similar research and development were done in hydraulic automation. Consequently, industry established and implemented a system of unified elements, SEGRA. Since the early 1970's, hydraulic components have been successfully developed (amplifiers, sensors, etc.) using jet technology and the principle of power compensation; in particular, a method of control for powerful flows of liquid was developed that uses eddy-type jet actuators.

In developing the electrical portion of the modular system, the institute created principles of design of automated industrial-type regulators using both analog and digital formats. The institute is a pioneer in developing contact-free regulators, automatic optimizers, and multichannel regulators.

The institute has focused much attention on the development of logic control devices. Much credit belongs to S. M. Domanitskiy, who created methods for studying complex logic circuits, principles of construction of variable logic devices.

If we begin with the work of the war years, which was discussed above, research and development of principles of construction, planning and application of contact-less magnetic automation devices have been widely developed at the institute. Consequently, the institute has become one of the leading centers in our country in magnetic control technology. The world's first general industrial series of magnetic amplifiers was developed and assimilated. Original magnetic-modulation magnetic-field voltage sensors (magnetic probes) have been developed and widely employed in equipment used for geomagnetic prospecting of minerals, magnetic defectoscopy, reproduction of magnetic recordings and in other fields.

Further research on magnetic elements led to the creation of analog memories, varistors, unified components which permit us to find and predict rejects in complex electronic circuitry.

The institute has been hard at work on research into magnetic domains and construction of digital logic and memories on this principle.

Industrial assimilation of modular systems made a remarkable contribution to the expanded resources of automated production technology and, accordingly, in the need for novel means of primary data collection during this process: sensors and meters. Over the course of several years, the lack of product variety of meters retarded the use of modular system resources; this problem was the center of attention of the institute's scientists.

Research on radioisotope monitoring carried out under the mentorship of N. N. Shumilovskiy produced a wide range of devices used to measure flow rate, level and compoisition of substances. The institute developed the theory and principles of construction of mass flowmeters, eddy-current transducers, magnetic gas analyzers and frequency sensors. Much work was done in the study and generalization of scanning methods of sensing spatially distributed quantities and fields.

The idea of constructing primary transducers using transient processes, which the institute promoted in the early 1960's, gave rise to a trend which evolved in several organizations. Studies done at the institute to improve the principles of balanced conversion of vectorial quantities led to elaboration of several unique serially-manufactured d.c. meters. An original method of analysis and synthesis of balanced sytems was developed on the basis of their study.

The hf radiowave method proposed by the institute aided in developing and introducing a new class of monitoring devices (over 30 types); they have better technical specifications than existing domestic and foreign devices of similar purpose. These devices include a serially-assimilated modular set of frequency level meters of liquid and bulk materials which tackles the basic problems of general-industrial level measurement, and is part of GSP.

Modular systems have enabled us to automate more complex technological processes whose monitoring had become a new, difficult problem. The control room, its arrangement and switchboard management all posed new problems connected with the interaction of man (operator, controller, etc.) and a system of devices.

The man/machine aspect of automated control systems began to undergo evolution at the institute in 1960. A hardware set including digital computer was developed; it made it possible to simulate complex processes and study operator performance under conditions similar to real ones. Research performed on operator work during simulated emergencies revealed some substantive heuristic elements in his activities. These results led to recommendations for improving control panels and training methods. New, efficient data display methods and hardware were developed: the hierarchical method, fiber-optics, sporadic monitoring systems to facilitate emergency prediction. The institute also promoted and realized the idea of the man/machine method of recognition and analysis of complex signals. This system, where input data are converted into color-coded patterns on a CRT, resolved several applied problems.

Within the first years following the war, the institute took a step forward in developing and utilizing methods and hardware for control system simulation. In contrast to the type ELI integrators and mechanical integrators popular at the time, the institute proposed using an op amp with various feedback circuits as the basic decision-making component in analog computers: it would guarantee performance of discrete linear and non-linear mathematical operations. This made real-time simulation possible and interfaced with actual control equipment. The development of these studies later led to the design of the type EMU series analog computers, a modification of which (EMU-10) is still in serial production.

In the late 1950's, the institute modernized its analog computers and started studying hybrid analog-digital computers.

In contrast to the method of designing hybrid computing systems (GVS) generally accepted at that time, consisting of the combination of serially-manufactured analog and digital computers, the institute switched to designing one from scratch. The first example of success of this approach was the hybrid computer systems developed in 1964-68 for a complex flight simulator. Based on this experience, in 1968-71 the GVS-100, a hybrid computer system with evolved software, was studied and devleoped in cooperation with the Institute imeni M. Pupin (SFRYu) [Federal People's Republic of Yugoslavia].

Experience gained in developing the GVS-100 and subsequent research led to the development of a new bi-level structured third-generation GVS and to new concepts of software design. This structure was realized in the "Rusalka" GVS introduced into industrial production.

In the 1960's, the institute began active work in digital computers, based on the idea of modular processors constructed of uniform media with variable structure. The goal of this research was to create theoretical and engineering foundations for construction of future computers of a new generation with high productivity reaching the hundreds and millions of operations per second, with low cost, high survivability and technological effectiveness of manufacture.

The high technical and economic indicators of this multi-processor system are guaranteed because of the use of novel principles of arranging the computing process, namely the principle of uniformity and the element, block or device level and regularity of coupling between them, the principle of program realignment of computer structures and systems at the micro and macrolevels, the principle of arrangement of parallel computing processes and decentralized control using uniform variable structures, the principle of associative and conveyor processing of information to assure group and flow processing of data banks, and the principle of equipment realization of a considerable part of software using associative memory. These principles underlied the foundation of planning and creation of a family of problem-oriented computers of increased survivability and high productivity. Five models of these computers have now been developed. The first model has parameters similar to a microcomputer and is designed to be used as a built-in in control devices for technological processes, in decentralized control systems, in terminals, etc. The second computer model has a structure which assures processing of several parallel flows of data using one flow of instructions. The third model has a structure which assures processing of several parallel data flows using several parallel instruction flows. The fourth model is problem-oriented toward effective solution of large-scale optimized problems. Orientation of a computer to solve some types of problems is done by preliminary training based on accumulation of experience from already solved problems, and later substantive features of previously solved problems are used to determine the set of solution procedures by analogy. The fifth model is oriented toward effective solution of information-retrieval problems with large data banks. Associative principle of systems organization has 2-3 orders faster data retrieval than known systems and simplifies data bank access.

Studies on creating new computers were naturally closely tied to studies of program software; this required the development of new ideas in systems and heuristic programming. The appearance of complex computing systems required the development of technical diagnostics studies.

At the institute were constructed the foundations of control theory for the computer's computing process; general algorithms of computer resource distribution were developed. Mathematical problems arising here required the creation of new branches of queuing theory, automation theories and combinatorial programming. In addition to theory, the institute developed experimental study methods.

A universal measuring system was developed which gathers information on the function of operational systems during normal operation. Methods were developed for using measurement data to increase computer throughput. The use of the measurement system makes it feasible to increase throughput by 30-40 percent.

Program optimization problems were formulated at the institute and the first methods and instrumentation for constructing large programming complexes were developed. This work was widely evolved and utilized to create programming software of many automated control systems.

In developing new methods of translator design, operational systems and data bank management systems, the research of the institute's scientists in mathematical linguistics and theory of graphs was widely used. Along the way, the problem always occurred of sorting organization. Its solution at the institute was handled with a simulation problem: the design of a chess game program. The KAISSA program developed by institute scientists won first prize at an international chess program championship.

To the institute belong the first developments of variable programming devices for monitoring complex objects, dating back to the 1950's. Some modifications of universal test machines (PUMA) developed jointly with other organizations productivity in monitoring operations. Activities of the institute in this field elicited active development of studies in automated monitoring in several sectors of industry.

Starting in the 1960's, the institute has worked on theory, methods and devices of technical diagnostics. Recently metholodological bases were created for technical diagnostics: methods of synthesis of self-testing circuits of built-in monitoring were developed and theoretical foundations for assuring high monitoring suitability of discrete objects were elaborated; methods of calculation of signal competition during diagnosis were investigated and developed for these objects. Work is being done to create and incorporate machine systems for planning diagnostic routines for discrete equipment during manufacture and operation.

Since 1970, the institute has been the main organization studying the reliability of hardware manufactured by Minpribor [Ministry of Instrument Making, Automation Equipment, and Control Systems]. B. S. Sotskov, corresponding member of the USSR Academy of Science, headed up this work. The essence of the work is the study of physical causes of rejection of devices and instrument components, automation and control system equipment. Research done at the institute on the physics of rejects of components laid the groundwork for creating methods of reject prediction and accelerated equipment reliability tests. The results of this work form the basis for developing guidance materials, sector standards necessary for enhanced reliability and guaranteed stability of production.

III Management of Groups and Communities

In the 1950's, the concept of the communality of control laws for objects of human nature was more and more expanded. It became generally recognized that the study of the patterns of management processes belongs among the fundamental, rapidly-evolving sciences. This concept, on one hand, and practical needs, on the other hand, evoked substantial expansion of scientific interests of institute scientists. By the early 1960's, the institute began to see an unfolding of studies linked with management processes in socio-economic and biological systems. The foundations for this work were laid as a result of all previous activities of the institute. The scope of research in this new area, the importance of these studies to the national economy of the country, and the results obtained resulted in a name change for the institute. In 1969, the institute became the Institute of Management Problems (Automation and Telemechanics).

Experience and qualification of institute coworkers, attraction of young scientists assured quite rapid development of these studies. Studies were begun in this direction in theory and practice of automation of administrative management of almost all levels of the country's national economy, for all its links--from comprehensive control of technological processes and individual enterprises to management of sectors of the national economy and their associations.

The institute was included in the development of some of the country's first automated management systems (ASU)--metal supply management system (ASU Metall), maritime transport management system (ASU Morflot). The institute was entrusted with scientific leadership because of its creation of these systems. At the level of enterprise management, the institute headed up the creation of ASU Tsement for the Sebryakovskiy Cement Plant, a pipe rolling production control system, the Moskvich Association's management system. These studies relied upon results of fundamental research of the institute. Thus, based on methods of queueing theory, the institute developed a system for airline bookings and reservations, SIRENA. This class of systems includes the ASU created and designed for a multi-profile hospital, including the Apteka [Pharmacy] subsystem. Resource distribution systems include the automobile spare parts supply system. This work was done on the basis of the institute's methods of analysis of multi-level organizational systems, analysis of the dynamics of economic indicators, methods of processing results of experimental inquiries. Realization of results of studies in creation of the ASU assured savings of several tens of million of rubles per annum.

Developments in automation of administrative management relied upon fundamental research in managing large complexes, one of whose aspects is the participation of people in the management process. In this direction, a wide range of studies have been done. Thus, problems of creating ASU required development of novel mathematical methods and models in the field of management of organizational systems, development of computing systems and the methods of management, development of methods of planning ASU oriented toward automation of planning these systems. The use of only some results in this field reduced the time consumed in developing several ASU projects by 40 percent.

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Substantial studies were made in mathematical theory of management of economic systems. Economic research at the institute began to evolve in the late 1960's. First came the problem of describing economic objects in terms of control theory. Research in this area led to the construction of a model which was suitable for calculations at different levels: at the enterprise, sector and intersector levels. This universality was achieved by having the general model contain all known aspects of all known economic objects.

In the mathematical sense, the economic model is a distinct object from those born out of mechanics and technology. This circumstance demanded new investigations into numerical methods and analytical conditions of optimalness. Numerical methods were developed to tackle linear dynamic problems of optimization with mixed constraints which made it possible to perform calculations of the optimum dynamic intersector balance; numerical methods were also evolved to tackle linear dynamic integral problems of optimization which were used to construct optimum sector plans of the enterprises. As concerns analytical research, as a result of establishment of the necessary and adequate conditions of optimalness for problems originating in economics, some results were obtained on the qualitative properties of optimum economic plans.

Administrative management deals with "active" objects. Activities of control objects are linked with the presence of a man in the system capable of predicting the consequences of decisions and planning activity based on said consequences. Formalization of the basic properties of activity of the economic system led to the notion of an active system. Theory of active systems has been developed at the institute since 1968. Methods of this theory have been used for analysis and evaluation of mechanics of operation in the national economic system (procedures of planning, mechanics of price-setting, stimulation, competition, organization of cost accounting) and development of recommendations for their improvement. Of principal value are the results of the theory such as strict reasoning of principles of consistent management, promoted by Soviet economists on a pithy level (theorems on optimalness of the principle of consistent management).

Research was conducted into the conditions stimulating an enterprise toward accelerated output of new products of increased quality; measures were proposed for economic stimulation of enterprises trying to assimilate new technology.

An experimental base was created to study management mechanics and test theoretical conclusions in the form of simulation routines: "Economics", "Demand-production", and a set of business games simulating subsystems of the national economy (business games "Plan", "Resource", "Planning NIR", "Repair", "Counterplan", "Quality", "Competition", etc.)

Typical of many management systems is the incompleteness of information on variables and the state of complex systems and objects--this encumbers formalization of systems models and management goals.

The "cost" of the observation and management process is exceptionally important in some cases. At the institute, several fundamental studies have been done which formed the groundwork for tackling applied problems in this field.

Design of information softwa·e for large ASUs requires exceedingly large amounts of programming and can assure creation of operating systems only with good organization of the data bases. It was therefore natural to combine algorithms of economic calculations with the data base management system--thus was born the idea of creating economic information systems (NES). In 1978, INES underwent trial operation and its use in normal operations is now envisaged.

IV. Control in Biology and Medicine

Work in this field began in the 1960's. The development of bionics and experience gained in designing computers and even more complex programs instilled hope that the management specialist could be useful in studying how the living brain processes information and controls several somatic functions. In this new, difficult field, institute work was focused on two problems: simulation of cerebral functions in processing of sensory information (mainly auditory) and experimental investigation of brain functions associated with motor control--maintenance of vertical posture and coordination of movements. Both trends were aimed at obtaining facts important to future work in robot technology.

In the field of brain functions associated with sensory signals, facts accumulated to date in morphology, neurology, etc., were sufficient to be combined and to construct neuron models explaining these facts at the schematic and cybernetic levels. It turns out that these models are interesting not only to physiologists, but also to technicians, because they "hint" at unusual schematic solutions to some problems. Significant results in this field were obtained under the leadership of N. V. Pozin.

It was a different story with the study of motor control. There were not enough facts accumulated to yield a model level of understanding (in the sense given to these words by management specialists). The institute's work was aimed at producing new experimental facts important for stating and understanding administrative problems. Almost ten years of work in this field on both healthy test subjects and patients in neurosurgical clinics, made it possible to reveal many new facts and create a method of computer utilization (later a special device, "the neurosurgeon's adviser") for management of brain surgery in Parkinson's disease.

Studies have been done at the institute for 15 years on simulation of processes of transmission of electrical stimulation to stimulated tissues (cardiac muscles). The statement of computer experiments in hybrid computing systems permitted some new notions to be derived during these studies concerning the mechanics of stimulus circulation.

The institute is a pioneer in developing methods of classification of states of biological objects. These methods are primarily aimed at solving problems of diagnosis of disease, classification of patient health and prognosis of the development of pathological processes. The statement of these problems implies a combination of formalized procedures and medical thought.

Studies in large-scale simulation of health care management processes were begun at the institute in the 1970's. It was found that the systems approach and methods used by management specialists to analyze complex systems make it possible to analyze the effectiveness of many functions of health care systems and to work up recommendations for improvement of this important system in state management. A functional and structural arrangement of the health care system has been developed with active participation of the institute, and a method of analysis of proportionality in the evolution of health care based on the construction and examination of a system of generalized indicators has been drawn up. Special attention has been given to analysis of processes of evolution of research in separate large-scale scientific medical programs. Formalized descriptions were written for dynamic processes in the health care system as processes of exchange between population groups (groups of the population differ in demographic characteristics, state of health, etc.).

Much research in the organization of health care has been done at the institute in close contact with domestic organizations and also within the framework of international cooperative agreements in biology and medicine with scientific organizations and scientists from countries in the socialist camp. Joint research is being done on problems of large-scale simulation of health care with the International Institute of Applied Systems Analysis (MIPSA).

In addition to the scientific research noted above, over the expanse of the 40 years of its history the institute has conducted great scientific and organizational studies. Hundreds of young scientists have been raised and educated in the graduate and post-graduate courses of the institute.

Many of them later moved about the country, organizing and often heading up new scientific centers in the field of management in several industrial cities of the country and in union republics.

The institute has established broad international ties with scientists and scientific organizations from foreign countries. The high scientific level of the group assures the institute's broad scientific acclaim among scientists.

Young scientists from almost all the socialist countries, the USA, England, France, Italy and other capitalist and developing nations have had on-the-job-training at the institute. In turn, many young scientists from the institute have studied at universities and science centers of socialist countires, the USA and Western Europe.

Ever since the Soviet Union entered the International Science Federation on Automated Management (IFAK), institute scientists have held leading posts and have participated in the work of all IFAK congresses. A. M. Letov was elected president of IFAK. The first IFAK congress was held in Moscow and the institute was one of the main organizers of this international forum of management scientists.

Institute scientists actively in the organizing and performance of IFAK symposia on automated management in space, on identification and evaluation of systems parameters, on the use of computer technology to control industrial processes and many others.

The institute is the support organization of the USSR National Committee on Automated Management within the committee and regularly arranges All-Union conventions, symposia, conferences and schools in this field. Institute scientists have made a great contribution to the work of the USSR Academy of Sciences' Committee on Systems Analysis.

The results of institute studies, starting with the World's Fair in Brussels in 1958, where they received the highest awards, are regularly exhibited at international and interunion exhibitions.

The institute heads up several joint studies with foreign scientific organizations within international agreements of the USSR Academy of Sciences on scientific and technical cooperation. A significant place in these studies belongs to the wide range of on-going research in cooperation with scientists in socialist countries.

The journal "Avtomatika i Telemekhanika" [automation and telemechanics] organized by the institute for many years was, and still is, in spite of new editions, one of the main sources of scientific information for scientists working in all fields of management science.

In the 40 years since the organization of the institute group, it has increased ten-fold over its initial size. It now consists of two academicians, three corresponding members of the USSR Academy of Sciences, 57 doctors in science and 245 candidates in science. The institute graduate program is training over 200 persons.

Over the span of 40 years, institute coworkers have published over 900 books and pamphlets and about 8,500 scientific articles in journals and various collections.

The institute is rightly considered the center of fundamental research in management problems.

The institute's ties with over 400 academic and sector institutes and industrial organizations help to bring research findings to realization and wide introduction.

Activities of the institute group have been recognized with high awards.

For great success in theory and practice of automated management and training of highly qualified scientific personnel, the Institute of Management Problems was awarded the Order of Lenin.

Academician B. N. Petrov and V. A. Trapeznikov received the titles of Hero of Socialist Labor.

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Many institute coworkers have received orders and medals for their successes.

A large group of coworkers have received the titles of laureates of the Lenin and State Prizes. Nine coworkers were awarded the Lenin Prize, institute coworkers received 23 USSR State Prizes. The USSR Academy of Sciences awarded the A. A. Andronov Prize to two institute coworkers and two others received the P. N. Yablochkov Prize. The Lenin Komsomol Prize was awarded to two young coworkers of the institute. Many institute studies have been recognized with medals and diplomas of international shows and the VDNKh.

The institute has every reason to be proud of what it has accomplished in 40 years. Furthermore, scientists of the institute understand how important and complex are the problems still to be tackled. In a period when management science is faced with problems of primary importance in both the mastery of space, new forms of energy, new technological processes, etc. and in socio-economics, scientists of the institute of management problems must provide the scientific groundwork for tackling these problems and achieve the wide and rapid utilization of scientific advancements in management to build the national economy and in state management.

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C. Publications

ABSTRACTS FROM THE JOURNAL PROGRAMMIROVANIYE

Moscow PROGRAMMIROVANIYE in Russian No 4, 1979 signed to press 19 Jul 79 pp 73, 79, 86, 91, 95-96

UDC 681.322.06.015

SOME FEATURES OF USING PASCAL IN A CONVERSATIONAL MODE

/Article by V. A. Kostin, Leningrad/

/Excerpt/ Efforts to create a time-sharing system (SRV) for teaching programming languages have been underway at LGU /Leningrad State University/ for a number of years. The first such system, based on the M-222 computer, was JOSS, a time-sharing system oriented to a certain subset of ALGOL-60 /1/. A conversational programmed instruction system (SPO) for programming languages, based on the El'brus 1 computer complex and using alphanumeric displays as terminals, is currently being developed at LGU. The first phase of the system is designed to teach basic constructions of programming languages; the second phase is designed to execute users' ALGOL-60 and PASCAL jobs in a conversational mode /2/.

This article deals with facilities for editing the source text and facilities for the step-type display of text on the screen and organization of debugging tasks. It is oriented to PASCAL.

The following requirements for the conversational control language were formulated in system design.

1. The control language must be extremely simple to avoid complicating the algorithm of the specific PASCAL job.

2. Features of the alphanumeric displays used as terminals (screen size limitation, necessity of storing conversation history, layout of the source text in lists, etc.) must be considered in the language structure.

3. The form of the users' conversation with the computer must satisfy the teaching requirements, i.e., the conversation must enable the user to develop skills in applying the "natural" facilities of PASCAL. Use of facilities not inherent to PASCAL must be kept to a minimum. It should be

noted that this led to the rejection of such an efficient conversational facility as direct steps [1, 3] since the principle of direct steps so distorts the structure of the program in a procedure-oriented language and its debugging techniques that use of them in systems aimed at teaching such languages is questionable.

UDC 681.3.06:51

STRUCTURE OF SYNTACTIC DEFINITIONS OF PROGRAMMING LANGUAGES

[Abstract of article by Red'ko, V. N., and Shkil'nyak, S. S., Kiev]

[Text] A study is made of the syntactic structure of programming languages. Parametric grammars of the recursive type (PGRT) are discussed as general models of syntactic definitions. Three levels of abstraction based on PGRT are evolved to fit the syntactic definitions oriented to development. Such definitions are classified by expressiveness and by complexity of the inference control mechanism. References 43.

UDC 519:681.2

ALGORITHM OF SELECTION IN OPERATOR SCHEMES OF DOMAINS OF CONSTANCY OF VARIABLES

[Abstract of article by Arkhangel'skiy, B. V., Kiev]

[Text] An algorithm of selection of domains of constancy of variables is discussed within which the variables retain their values for any set of source data during execution of the operator scheme. Properties of domains of constancy of variables are formulated. References 10.

UDC 681.3.06

SYNTACTIC ANALYZERS OF THE STACK TYPE. 2.

[Abstract of article by Dmitriyeva, M. V., Leningrad]

[Text] A class of stack analyzers is defined in the article and it is shown that a set of languages recognizable by the introduced class of analyzers coincides with a set of languages recognizable by generalized deterministic MP-automatons. References 2.

UDC 518.5:681.142.2

ELIMINATION OF TRANSFERS IN STANDARD PROGRAM SCHEMES

[Abstract of article by Nepomnyashchiy, V. A., and Sabel'fel'd, V. K., Novosibirsk]

/Text/ An algorithm is proposed which allows elimination of all transfers in standard program schemes with retention of operational equivalency. The lower limit of growth of size of the scheme is shown to be $(n/2)^{n/2}$ where n is the number of variables in the original scheme. Figures 3; references 3.

UDC 681.323

ALGORITHMS FOR DETERMINING THE SET OF ACTIVE PAGES (SEGMENTS) OF A PROGRAM, BASED ON THE DYNAMIC CYCLE CONCEPT

/Abstract of article by Kutepov, V. P., and P'yankov, V. P./

/Text/ A study is made of a family of algorithms for determining the set of active pages or segments of a program. The algorithms are based on the dynamic cycle concept; their high efficiency is confirmed by data from modeling. Figures 7; references 7.

UDC 51:681.3.06

MODIFICATIONS TO THE FLOYD-EVANS LANGUAGE

/Abstract of article by Bezrukov, N. N., Kiev/

A description is given of the MFEYa language which is a modified language of Floyd-Evans (FEYa) and is intended for writing syntactic analyzers. Figures 4; references 23.

UDC 681.3.06

ON THE QUESTION OF DEVELOPMENT OF THE STRUCTURE OF SOFTWARE FOR AUTOMATED DESIGN WITH MULTIPLE MODIFICATIONS

/Abstract of article by Zhintelis, G. B., and Karchyauskas, Kaunas/

Problems of developing the structure of software for an automated design system are considered. The system is based on the possibility of obtaining design alternatives derived by insignificant modifications of the input data. Figures 2; references 6.

UDC 681.3.06-192

SOME QUESTIONS OF PROGRAM IMMUNITY TO MACHINE MALFUNCTIONS.

/Abstract of article by Gorbatkov, M. A./

A technique is given for using the checkpoint method in various programming systems. Checkpoint (KT) interval organization is calculated assuming a Poisson stream of malfunctions. Figures 1; references 4.

UDC 681.3.068

WORD SIMILARITY ANALYSIS IN A SPELLING ERROR NEUTRALIZATION SYSTEM

[Abstract of article by Sidorov, A.A., Kuybyshev, Programmirovaniye, 1979, No 3]

/Text/ Problems of automatic correction of spelling errors as applied to programming systems are discussed. The concept of the measure of similarity of words is introduced and an original algorithm to determine the measure of similarity is given.

The suggested algorithm is illustrated by a PL/1 program. Figures 2; references 7.

UDC 681.3.068

ENSURING UNIVERSALISM IN A GENERAL-PURPOSE MACROGENERATOR OF THE YeS EVM

[Abstract of article by Voyush, V. I., Minsk, Programmirovaniye, 1979 No 3]

/Text/ Facilities determining the universality of the macrogenerator of the YeS EVM /Unified System of Electronic Computers/ are given. The syntax of macrocalls and control statements of the macrogenerator is discussed.

UDC 681.322.06.015

SOME FEATURES OF USING PASCAL IN A CONVERSATIONAL MODE

/Abstract of article by Kostin, V. A., Leningrad/

/Text/ One approach to conversational use of PASCAL is discussed. A method of program text layout in steps based on a formally defined step structure is discussed. Figures 1; references 5.

UDC 681.3.06

SYSTEM-GENERATOR FOR TESTING LINEAR PROGRAMMING PROBLEM-SOLVING ALGORITHMS ON THE YeS EVM

/Abstract of article by Grinshteyn, V. A., and Radashevich, Yu. B./

/Text/ Discussed are the structure, functional capabilities and principles of operation of a program generator of source data for experimental research on the YeS EVM of algorithms for solving several classes of linear programming problems. Figures 2; references 4.

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CSO: 1863

UDC 531.8+621.52

ALGORITHM FOR SYNTHESIZING THE PROGRAMMED MOVEMENT OF A JUMPING DEVICE FOR THE FLIGHT PHASE

Moscow ALGORITM POSTROYENIYA PROGRAMMNOGO DVIZHENIYA PRIGAYUSHCHEGO APPARATA DLYA FAZY POLETA in Russian 1979 Signed to press 28 Feb 1979 pp 3-6

[Annotation, introduction and table of contents from book by V. V. Lapshin, Institute of Applied Mathematics imeni M. V. Keldysh, USSR Academy of Sciences, Preprint No 26, 150 copies, 53 pp]

[Text] Annotation

In this work the author discusses the problem of synthesizing the programmed movement of a multilegged jumping device in the flight phase. He derives the first integrals of the equations of motion and constructs an algorithm for solving the boundary-value problem of synthesizing programmed movement for the flight phase. He demonstrates the possibility of a substantial simplification of the functioning of this algorithm for symmetrical movement of the device, and proposes a method for synthesizing the transient movement of the legs that insures an unstressed takeoff and a soft landing of the legs on the supporting surface. The algorithms were worked out by the method of mathematical modeling on a computer. The author presents the results of his calculations. The algorithm for synthesizing programmed movement is realized, using tables, for a rather extensive set of standard movement modes.

Kay words: multilegged device, jump, dynamics, movement control system, mathematical modeling.

Introduction

This monograph is a continuation of the research begun in [3] on the creation of a mathematical model of the motion and the movement control system of a jumping device. The supported phase of the device's motion was discussed in [3]. In this work we construct a mathematical model of the device's motion in the flight phase and solve the problem of synthesizing programmed movement in the unsupported phase.

The subject under discussion is a device consisting of a body and four or six two-element legs, each of which has three degrees of freedom. The total mass of the legs is a noticeable percentage of the body's mass. The device's motion consists of an alternation of two phases: supported, when all its legs stand on a supporting surface and quasi-static stability occurs, and unsupported or flight, during which the center of mass moves along a ballistic trajectory. Let us require that the device's legs separate from the supporting surface without any shock and that when landing they do so quite softly and with a low absolute stopping speed (zero speed is also possible). The requirement of a soft landing of the legs instead of a shockless one insures the reliability of the legs' contact with the supporting surface at the moment of landing if there are errors in execution or informational errors about the actual landing area.

In the problem of synthesizing the device's programmed movement during the flight phase, it is necessary to find those values of the device's linear and angular velocity that insure the transition from the given initial position to a given final position for the leg transfer method that has been adopted.

The first integrals of the device's equations of motion (the law of the motion of the device's center of mass and the law of the conservation of the moment of momentum relative to the center of mass) are derived in Section 1, and the mathematical model of the device's spatial movement in the flight phase is constructed. In Section 2, we formulate the boundary-value problem for synthesizing the jumping device's programmed movement in the flight phase and derive an economical algorithm for its solution. We propose a method for synthesizing the transient movement of the legs that insures a shockless takeoff and the required degree of softness of the legs' landing on the supporting surface. There is also a discussion of the possibility of a substantial simplification of the operation of the algorithm for synthesizing programmed movement in the case of symmetrical movement of the device. The results of the calculations are presented in Section 3.

For standard movement moves that encompass an extensive class of the most frequently encountered equipment movement modes, we suggest that the dependence of the body's initial angular velocity on the parameters of the upcoming flight phase be kept in mind. The amount of information to be remembered is relatively small. The magnitude of the body's initial linear velocity is computed. Such an approach sharply reduces the computation time and makes it possible to solve the problem of synthesizing programmed movement for the flight phase as the device is moving.

The algorithm for synthesizing programmed movement and the mathematical model of the jumping device's spatial movement during the flight phase were realized on a BESM-6 high-speed computer, in FORTRAN.

The synthesized programmed movement can serve as a reference for the construction of an algorithm for stabilizing the body's angular movement during flight.

The author wishes to express his deep gratitude to D.Ye. Okhotsimskiy for his formulation of the problem and attention to the work.

Contents

[96-11746]

11746
CSO: 1863

UDC 531.8+621.52

ALGORITHM OF STABILIZATION OF MOTION OF JUMPING APPARATUS IN FLIGHT PHASE

Moscow ALGORITM STABILIZATSII DVIZHENIYA PRYGAYUSHCHEGO APPARATA V FAZE POLETA in Russian 1979 signed to press 5 Apr 79 pp 3-8

[Annotation, table of contents and introduction from preprint no. 50 of the Institute of Applied Mathematics, the USSR Academy of Sciences, by V. V. Lapshin, 150 copies, 63 pages]

[Text] The unsupported phase of motion of a multilegged jumping apparatus is discussed in this work. An algorithm of stabilization of the angular motion of the body of the apparatus by changing the law of motion of the legs during flight is built. Results of mathematical modeling of the stabilization process on a computer are cited.

Key words: multilegged apparatus, jump, motion control system, mathematical modeling.

Contents

Introduction

The problem of stabilization of motion of a jumping apparatus in the flight phase is studied in this work. The algorithm of stabilization is one of the basic elements in a jumping apparatus motion control system.

An apparatus consisting of a body and four or six torque-linked legs each having three degrees of freedom is discussed. The total mass of the legs is a substantial portion of the body mass.

Apparatus motion consists in alternation of two phases: supported, during which all legs are standing on the support surface and quasi-static stability occurs, and the unsupported or flight phase. A mathematical model of three-dimensional motion of an apparatus was built for the supported and unsupported phases of motion in works [1-2]. The first integrals of the equations of motion were derived in the flight phase (the law of motion of the center of mass of an apparatus through a ballistic trajectory and the law of conservation of angular momentum of an apparatus relative to the center of the mass).

High speeds and accelerations, for the realization of which are needed great efforts and forces, are developed in the supported phase of motion of the jumping apparatus. Therefore it is advisable to construct the programmed motion in the supported phase of a jump in such a way that it can be realized with a minimal amount of efforts or forces developed at the leg joints. The problems of optimization of programmed motion in the supported phase and its stabilization were studied in work [1].

Discussed in this work is the problem of realization of the programmed motion, constructed in work [2], of an apparatus for the unsupported phase of a jump when various types of errors and disturbances occur.

The center of mass of an apparatus in the flight phase moves through a ballistic trajectory and its motion is uncontrolled. The angular motion of a body of an apparatus around the center of mass can be controlled by changing the law of motion of the legs during flight. For example, during bending (unbending) of the legs, their moment of inertia is changed; consequently, the effect on the angular motion of the body produced by the transposition of the legs is also changed, in conformity with the law of conservation of angular momentum. The possibility of changing the motion of animals and humans around the center of mass in unsupported motion through the motion of the extremities has been known for a fairly long time [3-7].

The aim of stabilization of motion of an apparatus in the flight phase is the outcome in the position prescribed in the programmed motion at the moment of landing taking into account the shift caused by deviation of the final position of the center of mass of the apparatus from that programmed.

The operation of a navigational and informational system is not modeled. It is believed that in the supported phase, all current phase coordinates of an apparatus are known without errors to the motion control system of the jumping apparatus, and in the flight phase--the coordinates and angular speeds of the body, as well as the angles and speeds at the leg joints. The terrain model is also known to the control system. At the moment of separation from the bearing surface, the model of the terrain in the domain of the landing corresponds to the real bearing surface to a certain degree of accuracy. During flight the model of the terrain in the domain of the landing is refined and becomes fully one of an adequate real bearing surface immediately prior to the moment of landing.

Concerning bearing areas, it is assumed that they differ little from the section of the plane and that their slope to the horizon is not large. The terrain as a whole may have a complex appearance.

Development of the algorithm of stabilization of motion of a jumping apparatus in the flight phase by the method of mathematical modeling on a computer made it possible to derive a sufficiently effective algorithm of stabilization.

The statement of the problem of stabilization of motion of an apparatus in the unsupported phase of a jump and a qualitative analysis of the different methods for constructing a stabilization algorithm are given in section 1. The advisability of using the principle of local determination of the additional controlling motion of the legs a step ahead in time is shown here. The logic of the operation of the stabilization algorithm is described in section 2. The nominal position of the apparatus at the moment of landing and the basic characteristics of the forthcoming phase of flight (its length, value of the vector of angular momentum of the apparatus relative to the center of mass, etc.) are determined. The problem of reorganization of apparatus motion in the concluding stage of the flight phase taking into account more precise information on the bearing surface, obtained during flight, is discussed. At the beginning and the end of the flight phase, the angles at the leg joints vary along the nominal trajectories of the transposition of the legs during flight, which ensures unstressed separation ond softness in placing the legs on the bearing surface. The angular motion of the body in the process is not stabilized. All the rest of the time, the legs take part at once in two motions: the nominal motion of the transposition of the legs during flight and the additional controlling motion, which ensures the variation of the angular coordinates of the body along the lines of transition, smoothly connecting the corresponding boundary values of the angular coordinates and speeds of the body. In sec 3, the problem of determining the additional controlling motion of the legs is reduced to the problem of quadratic programming of a special kind, the algorithm of solution of which is built in section 4. Mathematical modeling of the process of stabilization of the angular motion of a jumping apparatus in the flight phase (section 5) and the calculation results (section 6) show the efficiency of the algorithm of stabilization for various modes of motion of the apparatus when disturbances are present.

The author expresses deep appreciation to D. Ye. Okhotsimskiy for the problem statement and attention to the work.
[97-8545]

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UDC 62-50

AUTOMATED CONTROL SYSTEM FOR SHIPS

Moscow TEORETICHESKIYE VOPROSY POSTROYENIYA ASU KRUPNOTONNAZHNYMI SUDAMI (Theoretical Problems of the Construction of Automated Control Systems for Superships) in Russian 1978 signed to press 21 Nov 78 pp 2, 207-208

[Annotation and table of contents of book edited by V. A. Trapeznikov, Order of Lenin Institute of Control Problems of the USSR Academy of Sciences and the Ministry of Instrument Making, Automation Equipment and Control Systems, Izdatel'stvo "Nauka", 900 copies, 212 pages]

[Text] The collection contains a generalization of the experience and the results of new studies on the problems of constructing automated control [upravleniye] systems for superships: navigation, loading and unloading operations and the assurance of high levels of efficiency of the systems.

It is intended for scientists and engineering and technical personnel.

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AUTOMATED DATA SYSTEM DEVELOPED FOR ECONOMICS USE

Moscow AVTOMATIZIROVANNAYA INFORMATSIONNAYA SISTEMA DLYA EKONOMICHESKIKH OB'YEKTOV (Automated Information System for Economic Objectives) in Russian 1977 signed to press 1 Nov 77 pp 2-4, 244-245

[Annotation, foreword and table of contents from book by a group of authers, chief editor A. B. Florinskiy, Izdatel'stvo "Nauka", 2650 copies, 245 pages]

[Text] This work contains materials on the organizational-methodical support and software for the "ELLIPS" automated information system developed in the Laboratory of Information Problems of Control by the TsEMI [Central Institute of Economic Mathematics] of the USSR Academy of Sciences. Presented are a full description of the system (data languages, architecture, technology of operation, organization of a package of machine programs), reference materials for incorporation and operation (methods, instructions, forms), and descriptions of the algorithms and machine programs.

The book is intended for specialists developing systems for data base management, and for workers creating automated information systems for specific economic objectives.

The book was written by the following author's collective: A. B. Aronovich, chapters 6-8; N. G. Gorbatenko, B. P. Suvorov, Sections 1-2 of chapter 2; I. V. Gorshkov, section 3 of chapter 2, sections 2-3 of chapter 4, sections 6, 8 of chapter 5; A. B. Florinskiy, sections 4-5 of chapter 2, chapter 3, section 1 of chapter 4, sections 1-5, 7 of chapter five; P. Ye. Khazanov, chapter 1.

Foreword

At the present stage, systems of control of economic objectives are reaching a qualitative new stage in their development--the stage of automated management systems (ASU). This process was called forth by the complication of economic objectives and became possible thanks to the advances of computer engineering. Occurring in parallel with the development of systems for management of economic objectives as a whole is the evolution of their support subsystems, particularly data software subsystems. The data software subsystems of ASU have obtained the designation automated information systems (AIS).

The main distinction between AIS and traditional data systems is that the AIS perform centralized accumulation of data and make it possible to realize the potential advantages of such accumulation (comparability, reliability, lower prime cost, and so on), and also have hardware automating operations for input, preparation and output of data. Ultimately this distinction leads to improvement in the quality of management of the economic objectives, which, in light of the decisions adopted by the 25th CPSU Congress relating to development of the national economy, is especially timely.

The attempt to reduce the outlays for setting up AIS has stimulated the development of standard hardware which could be used in many automated information systems. At the present time two directions have been outlined in the designing of this hardware.

One of them proposes the development of hardware that if possible is more universal with respect to the data to be accumulated and processed. Such hardware has received the name of general-purpose data base management systems (SUBD; sistema upravleniya bazami dannykh). The universality insures for the SUBD a very broad circle of application; however it leads to complicating the task of creating automated information systems, to lowering the effectiveness of operation, and to an increase in the necessary computer resources. These costs of universality are connected with the factor that the data base management system is oriented to a certain class of formal data structures, so general that the actual information of many problem areas can be displayed in it. Also due to the universality of the data base management system as a rule, workers in the management apparatus (nonprogrammer-users) do not have available the convenient hardware insuring interaction with the AIS. Development of such an interface is regarded as an independent task, to be resolved in the process of setting up the automated information system.

Another direction proposes the development of hardware that is specialized with respect to the data to be accumulated and processed. Such hardware is oriented to one or several classes of real data structures, utilized in a certain problem area. This makes it possible to get along without the costs of universality indicated above, and also to have in the make-up of this hardware an interface which insures interaction between the workers of the management apparatus and the automated information system. Such hardware still has not received a generally accepted name. Here we, desiring to emphasize that orientation to real data structures will substantially simplify the task of creating an AIS, will use the term "AIS" (automated information system) for this purpose.

The book contains materials which make up the organizational-methodical support and the software of the "ELLIPS" AIS--the standard hardware specialized with respect to the data to be accumulated and processed. A full description of the system (data languages, architecture, technology of operation, organization of the machine program package), reference materials on introduction and operation (methods, instructions, forms), and descriptions of algorithms and machine programs are presented.

The "ELLIPS" automated information system is a factographic system performing the accumulation and the output on demand of economic indicators and derived data structures--tables and documents. Semantic data languages are used to describe the data during interaction between man and the system. When developing the system it was assumed that the degree of adequacy of feasible data structures for the traditional and that of the utilized data languages for the natural were very important characteristics of the system. The system also insures accumulation and output of data on paradigmatic relations between lexical units of data language, of classifiers, for instance.

The system can perform structural conversions and meaningful processing of stored data. The system allows two operating regimes: planned provision of data (ordered) and provision of data according to unplanned requests (spontaneous). These regimes are differentiated only in the organizational section.

The authors express their gratitude to all their friends and colleagues in scientific work who have aided in creating this book. They express especial thankfulness to V.M. Zherebin, B.I. Kruglikov, Ye.G. Yasin, conversations with whom helped to improve the book's content. Finally, the authors would like to thank all the associates who assisted in putting out the book, and particularly O.I. Gur'yanov and V.A. Il'in.

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AUTOMATED MANAGEMENT SYSTEMS FOR TECHNOLOGICAL PROCESSES IN GAS INDUSTRY (MODELING AND MACHINE SIMULATION)

Kiev ASU TEKHNOLOGICHESKIMI PROTSESSAMI V GAZOVOY PROMYSHLENNOSTI (MODELIPOVANIYE I MASHINNAYA IMITATSIYA) in Russian 1977 signed to press 17 Oct 77 pp 2, 79

[Annotation and table of contents from book by Vladimir Vasil'yevich Dubrovskiy and Vladimir Borisovich Shifrin, candidates in technical sciences, Izdatel'stvo "Tekhnika", 2,500 copies, 80 pages]

[Text] The structures of ASU TP (automated management system for technological processes) of the gas industry and the methodology of developing them through machine simulation and modeling are discussed. A detailed description of the stages in machine simulation is given, including modeling of objects and the control system. A technique for planning experimental study of this model and processing the data obtained is described. Included in the book are mathematical descriptions of practically all objects of management in the gas industry: wells, gas scrubbing plants, and systems for transporting and distributing it among consumers.

This book is intended for engineers and technicians engaged in creating ASU's for the gas industry, and in designing and testing systems for management of complex multiflow objects. Five tables, 15 illustrations, and 20 bibliographical entries.

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CSO: 1863

AUTOMATIC PROGRAMMING OF JACQUARD LOOM PATTERNS

Kiev AVTOMATICHESKOYE PROGRAMMIROVANIYE ZHAKKARDOVYKH TKATSKIKH RISUNKOV in Russian 1978, signed to press 10 Oct 1978 pp 4-6, 191

[Annotation, foreword and table of contents from book by Yuriy Aleksandrovich Zaborovskiy, Gennadiy Kuz'mich Morozov, Yakov Mikhaylovich Rebarbar and Mikhail Borisovich Senekin, candidates in technical sciences, and Anatoliy Ivanovich Petrenko and Vitaliy Petrovich Sigorskiy, doctors in technical sciences, Izdatel'stvo Tekhnika, 1,000 copies, 191 pages]

[Text] Annotation

In this book the authors discuss methods, algorithms, programs and equipment for automating the reading of patterns and patterning (the application of types of interweaving) for jacquard fabrics, as well as the packing of jacquard cards. It is intended for engineering and technical workers in textile industry enterprises. It can also be used by scientific workers in the field of pattern creation and the production of jacquard goods.

Foreward

A significant improvement in the quality of goods and a constant change in and improvement of the variety offered -- this is one of the most important goals that the 25th CPSU Congress set for light industry. Accelerating the production of jacquard fabrics and improving its efficiency are a component part of the overall problem of improving both the qualitative indicators and appearance of the fabrics.

In the assortment of fabrics produced by the textile industry, jacquard fabrics have the most attractive appearance. In contrast to looms fitted with other types of jaw-shaped mechanisms, looms with jacquard fittings make it possible to produce fabrics with patterns of practically any degree of complexity. In connection with this, the productivity of a loom with jacquard fittings does not depend on the complexity of the fabric's pattern, while replacement of one pattern by another is accomplished by a brief replacement operation for the jacquard board in the loom.

However, industry is still far from making complete use of the great capabilities of jacquard equipment because of the lengthiness and labor-intensiveness of the preparatory process for jacquard weaving, which is the programming of the jacquard pattern. In the existing situation, all the operations in this process -- manufacturing the pattern holder and cutting the jacquard cards from the holder on a card-cutting machine (in addition to perforating the cards) -- is done manually. Under industrial production conditions, the low productivity of the process of programming jacquard patterns, which is caused by the presence of a significant number of labor-intensive manual operations, impoverishes the available assortment, makes it impossible to replace obsolete patterns with new ones on a timely basis, and engenders a natural tendency toward simplification of the patterns themselves.

Both in the USSR and abroad, a number of specialized programming units, algorithms and programs for general-purpose computers have been developed that make it possible to automate this process to some degree. In essence, here we are talking about a completely new technology for programming jacquard patterns that is considerably more efficient than the existing one.

In this book we present the results of the theoretical and experimental research that we performed over a number of years. We also present the results of production testing and the introduction of samples of fabrics produced with the help of patterns that were programmed with the assistance of the automatic complex.

The complex's high productivity (up to 10 cards per minute) enables it to be used by setting up special centers in connection with associations. These centers will be able to serve a group of related enterprises that are engaged in producing jacquard fabrics. If we assume that the artists will also be concentrated in these centers, then the conditions will be created for the constant development and renewal of the goods assortment, as well as its diversity and the ability to react to market conditions and demand on a timely basis. The creation of a new goods assortment will make it possible to produce high-quality goods, which will have a large effect on the national economy.

According to preliminary calculations, the annual effect for the linen industry alone can be about 1-2 million rubles.

The authors wish to express their deep gratitude to Associate Professor Yu.S. Pavlenko, candidate in technical sciences, and Manufacturing Engineer I.B. Berlin for the valuable comments they made during the review of the manuscript, as well as the collectives of the Odessa Poligrafmash Machine Tool Design Office and the Poligrafmash plant, who performed a great deal of planning and design, assembly and adjustment work on the electromechanical assemblies of the experimental industrial prototype of the card-cutting complex.

We ask that comments and opinions be sent to the following address: 252601, Kiev, 1, GSP, Kreshchatik, 5, Izdatel'stvo "Tekhnika."

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UDC (69.001.2+721.23):681.3

AUTOMATION OF DESIGN OF UTILITIES STRUCTURES STUDIED

Tashkent AVTOMATIZATSIYA I OPTIMIZATSIYA PROYEKTIROVANIYA INZHENERNYKH SOORUZHENIY (Automation and Optimization of the Design of Utilities Structures) in Russian 1977 signed to press 27 Jun 77 pp 2-4, 99

[Annotation, introduction and table of contents from book by Israil Ibragimovich Ibragimov, Izdatel'stvo "Fan" UzSSR, 1,000 copies, 100 pages]

[Text] The book reports the results of research in the field of creating an automated system for designing facilities for construction, including a subsystem of optimal design solutions. The subject is presented in the form of a cybernetic system that is based upon mathematical modeling operators and informational look-up operations that are designed to variate the structure and the parameters of design developments. The object being controlled is the design that is being developed, and the controlling organ is an algorithm for modeling and optimization.

The monograph is intended for engineers, technicians and scientific workers and graduate students who are engaged in creating automated design systems.

Introduction

The main task of the Tenth Five-Year Plan (1976-1980) consists in the systematic execution of the Communist Party's policy of raising the material and cultural level of the people's lives, based upon the dynamic and proportional development of social production and a rise in its effectiveness, the acceleration of scientific and technical progress, growth in labor productivity and improvement in every possible way of work quality in all elements of the national economy*.

A majestic capital construction program is to be executed during the five-year plan. Capital investment volume during the Tenth Five-Year Plan will be increased by 24-26 percent over the Ninth Five-Year Plan.

In Uzbekistan capital investment volume during 1976-1980 will be about 20 billion rubles, versus the 12 billion rubles that was assimilated during

*Materialy XXV s"yezda KPSS [Papers of the 25th CPSU Congress], Moscow, Politizdat, 1976.

the preceding 5 years. The capital construction program, as 25th CPSU Congress decisions specify, should be realized practically without an increase in worker manning, that is, through growth in labor productivity, which has been set for 29-32 percent.

The brilliant instruction of V. I. Lenin, "Measures for raising labor discipline and labor productivity are becoming in particular the order of the day*," acquires special force for designers. In order to accomplish the intended growth in labor productivity in utilities construction, the following measures are necessary and important:

The perfecting of design solutions that will provide for a reduction in construction costs; and

The advanced development of fundamental and applied sciences and the introduction into construction of the results of scientific-research and engineering-design developments.

The growing volume and pace of the construction and restructuring of our cities face the designers and researchers who work in the area of construction with a large number of problems that are complicated and that have great national-economic and social significance.

The construction and installing work volume in our country is growing systematically: a conversion to industrialized methods for erecting buildings and structures is being accomplished. All this requires a systematic increase in the amount of design work and maximal use of the newest achievements of science and technology.

This monograph elucidates organization of the research and development of methods for solving tasks for the vertical and horizontal design of sites for the placement of civic structures. Formalization and modeling of processes for the design of construction sites and for the vertical design of sites for civic structures are conducted, and the bases for optimization procedures and schemes for the horizontal design of sites for utilities structures at a locality are developed. The definition of and the methods for solving the task of optimal siting of utilities structures at a given locality are examined. In accordance with basic methodological principles, the process of optimal siting is also called for by the cybernetic system, which is studied by means of mathematical models that are proposed. Great attention is devoted to optimal solution of the task of siting structures where so-called internal restrictions are imposed upon the design process.

Based upon the results of our studies, "Instructional Guidelines" for various developments in the design of utilities structures have been made up and sent out to design and scientific-research institutes of Gosstroy and Mintransstroy of USSR, and "Instructions" for preparation of the engineering task of the republic's automated system for constructional design operations--RASPKR--have also been sent to design institutes located within the Uzbek SSR.

*V. I. Lenin. Poln. sobr. soch. [Complete Collected Works], Vol 36, p 187.

The author considers it his pleasant duty to express gratitude to candidates of engineering sciences M. Abidov, K. Khudayberganov, A. I. Kozhukhin and Kh. Dzhumabayev and to junior scientific worker M. Urmanov for assistance in the preparation and formulation of this monograph and for valuable advice.

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AUTOMATION OF TECHNOLOGICAL PREPARATION BASED ON THE UNIFIED SYSTEM

Moscow AVTOMATIZATSIYA TEKHNOLOGICHESKOY PODGOTOVKI NA OSNOVE YESTPP (Automation of Technological Preparation Based on the Unified System of Technological Production Preparation) in Russian 1977 signed to press 8 Jul 77 pp 2, 147

/Annotation and table of contents from collection of articles, Izdatel'stvo standartov, 25,000 copies, 148 pages/

/Text/ This publication is the second issue in the series "Experience of Introduction of the YeSTPP" and deals with problems associated with the automation of the technological production preparation processes and their information support both in the overall methodological plan and in the instance of individual industries.

It is intended for engineers and technicians engaged in technological production preparation in various industrial sectors. Figures 26, tables 4, bibliography of 69 entries.

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[85-8545]

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CSO: 1863

COLLECTION OF CYBERNETIC TECHNIQUES IN BIOMEDICAL RESEARCH

Moscow and Leningrad KIBERNETICHESKIY PODKHOD K BIOLOGICHESKIM SISTEMAM (The Cybernetic Approach to Biological Systems) in Russian 1976 signed to press 23 June 77 pp 2-4, 157-158

[Annotation, preface, and table of contents from book edited by N. I. Moiseyeva, Scientific Council for the Complex Problem of "Cybernetics" of the USSR Academy of Sciences, 1,000 copies, 158 pages]

[Excerpts] Annotation

This collection presents summaries of work by associates at the Institute of Experimental Medicine of the Academy of Medical Sciences USSR in recent years in the field of biocybernetics and the application of computer technology in biomedical research.

The collection contains the results of studies concerning the problems of collecting signals of biological origin, feeding them to the computer, and mathematical analysis of them. It describes a large number of techniques for analyzing various types of data, from investigating neuron activity to program-based stereotaxic operations on the brain.

The articles in the main section of the anthology are devoted to investigations of biological systems for adaptive regulation.

This anthology will be of great interest to specialists in various fields: biologists, physiologists, medical scientists, engineers, and mathematicians, who are working on questions of analyzing biomedical information using computers, as well as persons interested in the processes of regulation in biological systems.

Preface

During the struggle in the formative stage of the field of cybernetics, Academician A. Kolmogorov defined his attitude toward its potential in the form of a statement: "I am one of the absolutely confirmed cyberneticists who sees no fundamental limitations in the cybernetic approach to the problems of life and believes that it is possible to analyze life in all its fullness, including the human consciousness in all its complexity, by the methods of cybernetics."* Today there is no need to establish the importance of cybernetics for the study of biological systems, but there is an unquestionable need to develop and improve cybernetic approaches in order to find answers to the traditional questions of the science of life: how and why. How and why does a biological system function? How can the data of biological studies be analyzed?

The present collection of articles, which summarizes the work of researchers at the Scientific Research Institute of Experimental Medicine of the Academy of Medical Sciences USSR in recent years in the field of cybernetics and the application of computer technology and biomedical research, was compiled to answer these questions. But this, of course, does not mean in general, but rather in application to specific problems.

The first sections of the book present results from studies concerned with the problems of organizing the collection of signals of biological origin, feeding them to the digital computer, and mathematical processing techniques.

These developments have quite a broad range of application, from techniques for studying neuron activity and multicellular activity to methods of evaluating the actions of a human operator; from procedures for determining the parameters of superposed peaks of the gas-chromatograph curve to programmed sterotaxic operations on a human being performed for purposes of research and therapy.

The articles in the third section of the book investigate systems of adaptive regulation with feedback not only for the purpose of understanding how and why the biological system functions but also to formulate ways to control the state of the human brain by influencing its homeostatic systems.

Thus, the articles in this collection are very diverse, which to some extent reflect the current tendency in the developments of cybernetics, which has not borne out hopes that it would bring about an integration of diverse knowledge in specialized sciences, which instead are experienced in a process of differentiation. Nonetheless, all the articles are joined by a common goal: the search to optimize study of the parameters of biological systems.

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* Kolmogorov, A., "Automata and Life," in "Vozmozhnoye v Kibernetike" [The Potential of Cybernetics], Collection of Works, Moscow, 1963, p 11.

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CSO: 1863

UDC 621.001:681.3

COMPUTER-ASSISTED MACHINE DESIGNING

Moscow ALGORITMY PROYEKTIROVANIYA SKHEM MEKHANIZMOV (Algorithms for the Designing of Systems of Machinery) in Russian 1979 signed to press 4 Jan 79 pp 2-3, 192-193

/Annotation, preface and table of contents of book edited by Doctor in Technical Sciences Professor N. I. Levitskiy, Scientific Council on the Theory of Machines and Machine Systems of the USSR Academy of Sciences and the State Scientific Research Institute of Machine Science imeni A. A. Blagonravov, Izdatel'stvo "Nauka", 2,000 copies, 196 pages/

/Text/ Algorithms and programs of the study of the dynamics of machinery with hydraulic and pneumatic devices, cyclic and composite machinery, walking machines and manipulators are cited in the collection. Solutions of problems of analysis and synthesis using electronic digital computers are given.

The collection is intended for scientists, engineers and designers, who are engaged in the designing of modern machinery and equipment using electronic digital computers.

Preface

The development of electronic computer technology and the effectiveness of its use have faced researchers with the problem of providing computers with large sets of complicated, well-developed algorithms which are convenient for computer implementation.

Algorithms for computers on the theory of the structure of machinery, the analysis and synthesis of linkages, cam gears, geared and composite machinery, the synthesis and dynamics of machinery with various devices which are used in automatic machines and instruments, the dynamics of machines, the productivity of automatic machines, the structural synthesis and control of automatic machines are the main content of the collection.

The development and adoption of the general-purpose algorithmic languages ALGOL, FORTRAN, PL-1 and others are enabling scientists, engineers, designers, instructors and post-graduate students to use the descriptions of algorithms for the solution of the problems of the planning and designing of modern machines and instruments using computers.

Algorithms which have been tested on domestic computers are published in the collection.

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COMPUTER PROCESSING OF ECONOMIC INFORMATION IN INDUSTRY

Moscow MASHINNAYA OBRABOTKA EKONIMICHESKOY INFORMATSII V PROMYSHLENNOSTI in Russian 1978 signed to press 19 Apr 1978 pp 2, 351-2

[Annotation and table of contents from the book by Sergey Ivanovich Volkov and Anatoliy Nikolayevich Romanov, "Statistika," 17,000 copies, 352 pages]

[Text] This textbook examines questions concerning the organization of computer processing of economic information in industrial enterprises and in organs of industrial management. A significant position is given to the principles of creation of computer data processing systems and their practical realizations on modern computers.

The book is intended for VUZ students. It will also be useful for practical workers.

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COMPUTERS IN AGRICULTURAL ENGINEERING

Moscow VYCHISLITEL'NAYA TEKHNIKA V INZHENERNYKH I EKONOMICHESKIKH RASCHETAKH (Computer Technology in Engineering and Economic Calculations) in Russian 1978 signed to press 31 May 78 pp 2, 223-224

/Annotation and table of contents of book by Vladimir Trofimovich Sergovantsev and Vasiliy Vasil'yevich Blednykh, Izdatel'stvo "Statistika", 10,000 copies, 224 pages/

/Text/ The principles of solving problems on computers are set forth in the book. The preparation of the scheme of modeling on analog computers, the elaboration of algorithms and program writing (AP /Automatic Programming/ for the Nairi computer and BASIC-FORTRAN) and the mathematical methods for solving agricultural production problems on digital computers are covered in detail.

The book also acquaints the reader with the general principles of the operation of computers. The textbook is intended for students of the engineering departments of agricultural VUZ's. It may be useful to engineering and technical personnel who are studying questions of the preparation of problems for solution on computers.

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CONTROL SYSTEMS FOR MANIPULATIVE ROBOTS

Moscow SISTEMY UPRAVLENIYA MANIPULYATSIONNYKH ROBOTOV in Russian 1978 signed to press 19 Nov 78 p 4, 5-6

[Annotation and Table of Contents from book by Vladimir Stepanovich Medvedev, Aleksey Grigor'yevich Leckov and Arkadiy Semenovich Yushchenko; edited by Ye. P. Popova, Nauka, 4,500 copies, 416 pages]

[Text] The hierarchical structure of design of control systems for manipulative robots and the principles of operation of such systems are described in this book. The basic emphasis is on problems of mathematical description and on studies of manipulative systems by digital computers. Mathematical tools, which provide a compact notation for the dynamics of multilink mechanisms, are developed, which also represent algorithms for modeling their kinematics on digital computers. Those tools are used to describe manipulator control systems. New algorithms for semiautomatic control of manipulators are investigated. Questions of analysis of stability and of dynamic properties of control systems for manipulative robots are considered as well as some questions of their synthesis.

One hundred eighty-three illustrations and 116 bibliographic citations.

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CONVOLUTIONAL CODES FOR INFORMATION TRANSMISSION

Moscow SVERTOCHNYYE KODY DLYA PEREDACHI DISKRETNOY INFORMATSII (Convolutional Codes for Transmitting Discrete Information) in Russian 1979 signed to press 15 Jan 79 pp 2-4, 220-221

/Annotation, preface and table of contents of book by Al'bert Emmanuilovich Neyfakh, Scientific Council for the Complex Problem "Cybernetics" of the USSR Academy of Sciences, Izdatel'stvo "Nauka", 1979, 1,700 copies, 224 pages/

/Text/ The monograph is devoted to the theory of jamproof coding by the method of convolutional codes. The means of assigning convolutional codes, the algebraic and probabilistic methods of decoding them are examined. Diagrams of the decoding of convolutional codes for work in channels with a memory are studied. Diagrams of the implementation of convolutional codes and methods of synchronization and the combatting of the propagation of errors are presented.

It is intended for communications specialists. 14 tables; 75 figures; 105 references.

Preface

The possibilities of detecting and correcting errors in communications channels using rationally calculated additional (redundant) symbols were always enticing to communications engineers and attractive to researchers. Various methods of introducing such redundancy and the evaluation of their effectiveness are the content of the theory of jamproof coding, which has been under development for the past 25 years. However, the works on coding theory concern primarily block codes. There is no academic course or monograph, which gives an extensive account of the theory and the means of decoding and using convolutional (recurrent) codes.

This prompted the author to collect materials from journal publications, to combine with some original results and to deliver at the People's University of Radio Electronics in 1972 a series of lectures on the theory and realization of convolutional codes, on the basis of which this book was written.

It is known that convolutional codes are difficult to give an account of and to analyze. Therefore in the book an attempt is made to set forth the material from a uniform methodological standpoint, which is based on the obvious fact that all the means of describing one convolutional code or another should unequivocally correspond to each other. In this connection the material is presented starting with the means of assigning the codes.

Owing to space limitations only the main known types of convolutional codes and the means of their decoding are described. It can be hoped that the material of the book as an introduction to the theory of convolutional codes will be useful to the reader when studying special questions in journal articles.

The author considers it his pleasant duty to express profound gratitude to Doctor in Technical Sciences S. I. Samoylenko, Professor L. M. Fink, senior scientific staff members and Doctors in Technical Sciences K. Sh. Zigangirov and K. A. Brusilovskiy and senior scientific staff member I. M. Boyarinov, whose advice and support contributed to both the writing of this book and the improvement of its content.

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ELECTROMECHANICAL PRINTERS

Moscow ELEKTROMEKHANICHESKIYE PECHATAYUSHCHIYE USTROYSTVA in Russian signed to press 8 Feb 78 pp 2, 10, 13, 64, 65, 96, 97

[Annotation, table of contents, bibliography and excerpts from the book by Valentin Vasil'yevich Baburin, editorial staff: I.V. Antik, G.T. Artamonov, A.I. Bertinov, A.A. Voronov, L.M. Zaks, V.K. Levin, V.S. Malov, V.E. Nize, D.A. Pospelov, I.V. Prangishvili, O.V. Slezhanovskiy, F.Ye. Temnikov, G.M. Ulanov, M.G. Chilikin and A.S..Shatalov, Izdatel'stvo "Energiya," 10,000 copies, 97 pages]

[Text] The design principles of electromechanical printers used as the output devices in computers, digital measurement instruments and various automation units are treated in the book.

A classification is given for electromechanical printers, and the basic physical and technical printing processes are described. The monitoring of the correctness of symbol printing and several criteria for evaluation the operational efficiency of electromechanical printers are analyzed.

The book is intended for specialists in computer engineering, automated control systems and students in the corresponding specialties.

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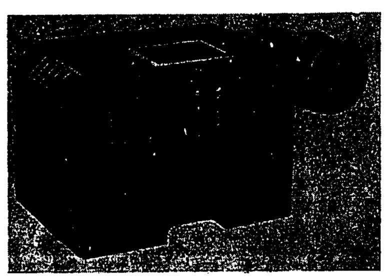

Figure 7. The MP16-2 Printout Mechanism.

The print rate is no less than 1,500 lines per minute. The number of characters per line is 16. The number of symbols is 16. The overall dimensions are 190 x 189 x 385. The weight is 12 kg.

TABLE 1. The Main Characteristics of Paper Quality

Parameter	Paper Number 1	2	3	State Standard Number
Fiber content (bleached rag pulp and cellulose), %	No less than 25, No more than 75	100 –	No less than 50 –	7500-65 –
Weight per square meter, grams	80	45;63; 70;80	63	13199-67
Sizing, no more than, mm	1.25	1.25	1.25	8049-62
Ash content, no less than, %	6.0	6.0	6.0	7629-66
Average smoothness on the face and wire sides	120	120	100	12765-60
Whiteness, %	77.0	77.0	64.0	7690-66
Dirt particle content (number of dirt particles with an area of from 0.1 to 0.5 mm^2 per square meter), no more than	125	125	200	13525-68
Moisture, %	7	7	7	8428-57

TABLE 2. The Main Types of YeS [Unified System] Printers and Subscriber Stations, AP's

Printed Type Vehicle	Type of Printer	Nation Producing the Unit	Print Speed	Category	Series Production Year
Drum	YeS-7030	USSR	900 lines/min	II**	–
	YeS-7031	GDR	900 lines/min	II	–
	YeS-7032	USSR	900 lines/min	I*	1972
	YeS-7033	Poland	1,100 lines/min	II	1972
	YeS-7034	Czechoslovakia	900 lines/min	II	1973
	YeS-7035	GDR	900 lines/min	II	1971
	YeS-7037	Czechoslovakia	1,000 lines/min	I,II	1975

TABLE 2 [continued]:

Printed Type Vehicle	Type of Printer	Nation Producing the Unit	Print Speed	Category	Series Production Year
Chain	YeS-7038	Czechoslovakia	-	II	1973
	YeS-7039	GDR — Czechoslovakia	1,200 line/min	I	1976
Lever Action Mechanism	YeS-7041	USSR	10 char/sec	-	1971
	YeS-7048	Czechoslovakia	10 char/sec	II	1973
	YeS-7072	-	-	-	-
	YeS-7073	GDR	10 char/sec	II	1971
	YeS-7074	Bulgaria	10 char/sec	II	1970
	YeS-7077	Czechoslovakia	10 char/sec	II	-
	YeS-7172	Czechoslovakia	10 char/sec	II	1970
	YeS-7173	GDR	10 char/sec	II	1971
	YeS-7174	Bulgaria	15 char/sec	II	1972
Matrix	YeS-7181	Czechoslovakia	25 char/sec	II	1975
	YeS-7183	GDR	100 char/sec	II	1973
	YeS-7184	Hungary	245/110 char/sec	II	1973
	YeS-7185	Poland	-	-	-
Chain	AP-7101	USSR	20 char/sec	I	1974
	AP-7102	USSR	400 line/min	I	1975
Drum	AP-7104	USSR	30 char/sec	I	1976

*I Increased climatic requirements;
**II Wide applications.

TABLE 3. The Paramaters of the Major Alphanumeric Printers of the Unified System with a Drum Printed Type Vehicle

Параметры основных алфавитно-цифровых печатающих устройств ЕС с барабанным шрифтоносителем

Тип печатающего устройства 1	[illegible] 2	Скорость печати, строк/мин 3	Число печатных экземпляров 4	5 Скорость перемещения бумаги, м/с	6 Ширина бланка, мм	7 Потребляемая мощность, кВт	8 Габариты, мм	9 Масса, кг
ЕС-7030 СССР 10	[illegible]	[illegible]/890	2	18/10	80—420	1,5	1520×689××1425	420
ЕС-7031 ГДР 11	[illegible]/120	900/1200	3	20,7/6	60—420	2,0	2770×670××1261	750
ЕС-7032 СССР 12	128	900	5	—	80—420	2,0	1600×650××1270	600
ЕС-7033 ПНР 13	128/160	600/1200	3—5	13,5/5,36	458	2,5	1250×820××1270	—
ЕС-7034 ЧССР 14	132	900	5	[illegible]	430	2,0	1370×780××1400	—
ЕС-7035 ГДР 15	—	900	—		—	—	—	—

Key:
1. Type of printer;
2. Line length, characters;
3. Print rate, lines per minute;
4. Number of printed copies;

[Key to TABLE 3, continued]:

5. Rate of paper travel, m/sec;
6. Blank width, mm;
7. Power consumption, KW;
8. Dimensions, mm;
9. Weight, kg;
10. YeS-7030, USSR;
11. YeS-7031, GDR;
12. YeS-7032, USSR;
13. YeS-7033, Poland;
14. YeS-7034, Czechoslovakia;
15. YeS-7035, GDR.

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EXPERIENCE IN THE OPERATION OF A CONSULTATIVE-DIAGNOSTIC POINT OF A COMPUTER DIAGNOSTIC SYSTEM FOR ACUTE CRANIAL BRAIN TRAUMA

Leningrad OPYT RABOTY KONSUL'TATIVNO-DIAGNOSTICHESKOGO PUNKTA VYCHISLITEL'NOY DIAGNOSTIKI OSTROY CHEREPNO-MOZGOVOY TRAVMY in Russian 1977 signed to press 2 Oct 1977 pp 2, 136

[Annotation and table of contents from book by Natal'ya Ivanovna Moiseyeva and Grigoriy Danilovich Luchko, Izdatel'stvo Meditsina, 3,000 copies, 136 pages]

[Text] Annotation

In this book the authors generalize their personal experience in the matter of rendering consultative assistance (using the capabilities of computer technology) to practical physician-traumatologists and neurosurgeons when a rapid diagnosis of acute cranial-brain trauma is needed. They discuss the difficulties of the diagnostic process, the causes of medical errors, the capabilities and limitations of computer diagnosis, the possibly accuracy of a diagnosis achieved by the computer method, and its profitability.

They define more precisely the selection of symptomatology and their general approach to the separation of diagnostic groups during the rapid diagnosis of acute cranial-brain trauma. They also describe the general organization of the operation of a computer diagnostic point, with detailed methodological directions and a description of the order of actions of the medical personnel in a hospital and the workers at the consultative point.

This book is intended for neuropathologists, neurosurgeons, traumatologists and emergency room physicians.

The book contains 20 tables, 2 figures and a bibliography of 167 titles.

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INFORMATION-LOGIC MODELS OF SCIENTIFIC RESEARCH

Moscow INFORMATSIONNO-LOGICHESKIYE MODELI NAUCHNYKH ISSLEDOVANIY in Russi n 1978 signed to press 5 Jun 1978 pp 2, 343-344

[Annotation and table of contents from the book by Galina Grigor'yevna Balayan; Galina Grigor'yevna Zharikova and Nikoley Ivanovich Komkov; editor: Dr in Economic Sciences Yu. R. Leybkind, Izdatel'stvo "Nauka," 4,700 copies, 344 pages]

[Text] This monograph sets forth a goal directed appr ch to an information processing conception of the processes of carrying out scientific research and development, making possible an adequate information processing representation of the course of the solution of problems from a unified position for the performers and the managers of R and D (Research and Development). The procedures of an information processing conception of R and D permits the essential information about the preparation for and the course of solution of scientific problems to be represented in a compact form convenient for analysis.

The book is intended for a wide range of readers, specialists in the field of the organization and economics of science, and also scholars working in various areas of science.

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METHODOLOGY OF DESIGNING SYSTEMS FOR AUTOMATING SCIENTIFIC-ENGINEERING EXPERIMENTS

Moscow PRIBORY I SISTEMY UPRAVLENIYA in Russian No 6, 1979 pp 47-48

[Article by P. B. Melekhov, candidate in technical sciences]

[Text] The problem of automating experimental work, as we know, has taken on special urgency at the present time. When we evaluate the research state-of-the-art, we must note the swelling demand for autonomous applied theoretical concents; their formation still lags far behind the pressures of practice.

In recent years a large number of studies appeared in domestic and foreign periodicals about advances in some aspects of the theoretical essentials of the designing of systems for automating experiments based on computers; their bibliography numbers several dozens of articles. So the publication of V. M. Yegipko's monograph[1] is all the more timely.

The author of the book reviewed is a notable Soviet specialists in the automation of scientific research.

The book under review is aimed at developing scientific formalized methods of designing systems for automating scientific and engineering experiments and is intended for design engineers designing and building specific systems. The book generalizes and systematizes experience in developing a number of systems for automating scientific and engineering experiments and in design methodology; the book also establishes some general principles for organizing and design computer systems for scientific research laboratories in different specialization areas.

Five chapters make up the monograph. The wide-ranging bibliography has more than 200 references. Chapter One in the book examines the role, tasks and trends in the progress made in systems for automating scientific

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[1] V. M. Yegipko, "Organizatsiya i proyektirovaniye sistem avtomatizatsii nauchno-tekhnicheskikh eksperimentov" [Organization and Designing of Systems for Automating Scientific and Engineering Experiments], Kiev, Izd-vo "Naukova dumka," 1978. 3300 copies, 232 pp.

and engineering experiments; it shows the importance of the systems approach to designing and gives an evaluation of different principles in constructing systems for automating scientific and engineering experiments based on domestic or foreign computers.

Chapter Two analyzes scientific and engineering experiments as objects for automation; it describes in detail the general properties of experiments as objects of automation, computer-assisted, and proposes a classification of scientific and engineering experiments that makes it possible, when designing systems for automating scientific and engineering experiments, to draw up the requirements on the system, to work out and use model solutions as applied to tasks in automating experiments in different classes, above all with respect to equipment and software. This chapter includes very interesting material on a comparative evaluation of different methods of the mathematical description of experimental studies.

Presented in Chapter Three are methodological principles of organizing and designing systems for automating scientific and engineering experiments; the main tasks, stages and features of designing systems for automating scientific and engineering experiments are analyzed; extensive and very interesting operating experience of the Institute of Cybernetics, Ukrainian SSR Academy of Sciences, in this field is generalized.

The methods of analyzing and synthesizing systems for automating scientific and engineering experiments are described in detail in Chapter Four. Here special mention must be made of material on evaluating the accuracy of experimental data in automated investigations. Discussed in a chapter section is an analysis of possible sources of errors in systems for automating scientific and engineering experiments and ways are determined for estimating the accuracy of characteristics of the object studied from the viewpoint of the information theory of measurements.

Chapter Five familiarizes the reader with the organization and designing of systems for automating scientific and engineering experiments of different classes. This material is about specific structures of systems for automating experimental studies in different areas of science and technology. However, even though this chapter takes up a good part of the total book, the discussion of specific systems of different purposes is extremely laconic and in some cases is superficial and merely descriptive. This flaw, sadly, is true also of some parts of the monographs in Chapters One and Three.

In judging the book, we must note that we cannot fully agree with all the recommendations and conclusions of V. M. Yegipko. Some are very debatable; some of the author's points of view are not well-founded.

But the solid merits of the book are beyond doubt: the book fosters the formation in design engineers of a scientific methodological way of approaching the tasks of organizing and designing systems for automating scientific and engineering experiments and presents current methods of analyzing and synthesizing these systems.

The book is intended for a wide range of specialists in technical cybernetics; it can also be recommended as a textbook for students in academic departments for advanced training in the specialty "Automation of Experimental Studies," which have recently been set up in many leading institutions of higher learning across the country.
[394-10123]

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MICROPROCESSORS USED FOR MODELING

Moscow MODELIRUYUSHCHIYE MIKROPROTSESSORNYYE SISTEMY in Russian 1979 signed to press 29 Jan 79 pp 2, 119-121

[Annotation, table of contents and bibliography from the book by Roman L'vovich Tankelevich, Editor: I.M. Vitenberg, Izdatel'stvo "Energiya," 9,000 copies, 121 pages]

[Text] This book is devoted to questions of the construction and utilization of modelling systems based on microprocessors--modern components of computers. The results of research on possibilities for their use in the capacity of a universal, programmable element of models are reflected in different variants of the construction of the modelling systems.

The book considers the theory and software of microprocessor modelling systems, and the influence of the features of several types of microprocessor on the efficacy of these systems.

This book is directed to a broad range of specialists, working in the area of the development and use of the capacities of computer technology. It may be useful to all who are interested in the use of microprocessors and modelling and also to students in the upper levels of the VUZ's specializing in relevant fields.

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NEW TEXTBOOK ON CONSTRUCTION, USE OF KEYBOARD COMPUTERS

Moscow EKSPLUATATSIYA KLAVISHNYKH VYCHISLITEL'NYKH MASHIN (The Operation of Keyboard Computers) in Russian 1978 signed to press 18 Jul 1978, p 403-405, 407

[Annotation and table of contents of book by A. Z. Levinson, R. N. Nikitina, K. Petrashchuk, T. I. Vil'vanova, G. V. Sidorenko, S. A. Fedorova, and V.P. Chuprikov, Izd. "Statistika," 20,000 copies, 408 pages]

[Text] Annotation

This textbook presents the structural and operating principles and technical-operating capabilities of keyboard computers. Considerable attention is devoted to computation procedures and effective methods of using the machines.

The book is intended for students in secondary specialized schools. It may also be used by practical workers at computing installations.

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OPTIMIZING COMPUTER RADIO ELECTRONIC CIRCUITS

Moscow MASHINNAYA OPTIMIZATSIYA ELEKTRONNYKH UZLOV REA (Machine Optimization of Electronic Assemblies of Radioelectronic Apparatus) in Russian 1978 signed to press 28 Jun 78 pp 2-5, 192

[Annotation, foreward and table of contents from book by Anatoliy Grorgiyevich Larin, Dmitriy Ivanovich Tomashevskiy, Yuriy Mikhaylovich Shumkov and Valeriy Makhaylovich Eydel'nant, Izdatel'stvo "Sovetskoye radio", 10,700 copies, 192 pages]

[Text] The book is devoted to questions of development and introduction of a problem-oriented group of programs for analysis and optimization of radioelectronic circuits on electronic computers of average productivity. A description is given of the developed group of programs oriented to producing radioelectronic circuits of average complexity.

The book is intended for engineering and technical personnel engaged in the development of electronic devices for automation, radioelectronics and measuring equipment. It will also be useful to students in higher educational institutions.

Foreword

High and varied demands are made of modern radioelectronic apparatus (REA), as a result of which it is distinguished by great complexity. The designing of such REA, the creation of the optimum variant of a technical solution in compressed periods are accompanied by a number of difficulties, the main ones of which are:

the impossibility for a person to consider the huge number of diverse factors affecting the technical solution;

the great labor-intensiveness and cost of manufacturing a mock-up of the product, especially in the case of integrated technology;

the complexity of imitating the conditions under which modern radio electronic apparatus should operate.

One of the ways to overcome these difficulties without a substantial increase in the number of workers is to use the potentials of modern electronic computers, which will make it possible to replace the mock-up of a radioelectronic assembly by a mathematical model of it, to replace the complex of measuring and testing equipment with programs for analysis, optimization and testing, and then to work out the assemblies on electronic computers by using this mathematical complex.

This book is devoted to questions of effective use of electronic computers of average productivity for solving problems of circuit engineering design for radioelectronic apparatus. The results cited were obtained by the authors in the process of development, improvement and introduction into practice of the design of a group of programs for simulation, analysis and optimization of the MODEL' radioelectronic circuits. The algorithms presented in the work were brought up to the level of an operating system of programs. The system's basic programs are recommended for use by the sector standards "Analysis and Optimization of Radioelectronic Circuits on Electronic Computers."

The authors are not undertaking to develop new methods of simulation, analysis and optimization. The book is mainly occupied with questions of adaptation, modification and program realization of known methods with application to electronic computers of average productivity and taking into account the specifics of a certain class of radioelectronic circuits. These are the analog circuits, standard for products in data processing and measuring equipment: frequency-selective units (passive and active filters), amplifying devices (video amplifiers, selective amplifiers), assemblies for transceiving apparatus, corrective circuits and networks, and so on.

Considered in the book is one of the possible approaches to development, organization and operation of a problem-oriented group of programs with maximum orientation to the user.

An analysis is made in chapter 1 of the traditional process of designing complicated radioelectronic equipment and the place in it of modern electronic computers and the optimum method of its use are determined. The most general requirements for the composition and technical characteristics of a group of programs for analysis and optimization are formulated.

In chapter 2 the requirements for programs of formation and analysis of a mathematical model of a circuit are formulated. Methods and algorithms of constructing an alphanumeric model of the circuit and its analysis are considered. The results of theoretical and experimental comparison of a series of algorithms and programs are presented.

Chapter 3 is devoted to the question of program realization of algorithms of shaping and analysis of the circuit model. Possible ways of increasing the effectiveness of the analyzing programs and the results of realization of some of them are indicated. Algorithms of analysis of linear electronic circuits in the frequency and time spheres and on a complex plane are presented. Structural schemes of programs and examples of calculations are given.

Considered in chapter 4 are the questions of optimal utilization of the results of multiple analysis during solution of problems of parametric optimization. The most acceptable set of optimization algorithms is selected taking into account the potentials of the electronic computer. A structural diagram of the developed group of programs for analysis and optimization is given.

Chapter 5 is devoted to consideration of the questions of practical use of the programs when developing modern radioelectronic apparatus. The ways of improving the method of using electronic computers are shown. The necessity for standardization of the methods of machine design is substantiated, and its priority tasks are outlined. The principles of building a system of automated design of electronic circuits based on electronic computers are presented.

The foreword and chapter 1 were written jointly by D.I. Tomashevskiy and V.M. Eydel'nant, sections 2.1, 2.4 and chapter 4 were written by V.M. Eydel'nant, section 2.2 was written by Yu.M. Shumkov, sections 2.3, 2.5 and 4.6 were written by A.G. Larin. Chapter 3 was written jointly by A.G. Larin and Yu.M. Shumkov, chapter 5 was written jointly by A.G. Larin, D.I. Tomashevskiy and V.M. Eydel'nant.

The authors assume that the book will be useful for developers of radioelectronic apparatus who desire to use machine design methods, and that it will also be of definite interest for scientific and engineering and technical personnel engaged in the development and introduction of machine methods in the practice of designing.

The authors are grateful to Y.N. Matviychuk, author of the TOPAN-4 program, for the information about the program kindly given to them.

In addition to the authors, also participating in the development of the programs realizing the presented algorithms were engineers V.B. Aronov, L.A. Alekseyeva, V.N. Vlasenko, L.A. Korud, S.N. Dusheba, and S.R. Sagaydachnyy.

The authors are grateful to the reviewers: Doctor in Technical Sciences D.I. Batishchev, Candidates in technical sciences V.K. Sirotko, S.I. Sirvidas, and L.M. Zak for valuable remarks and advice received in the course of working on the book.

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ORGANIZATION OF DATA IN COMPUTER SYSTEMS

Moscow ORGANIZATSIYA DANNYKH V VYCHISLITEL'NYKH SISTEMAKH in Russian 1978 signed to press 10 Nov 78 pp 2, 183-184

[Annotation, taple of contents and references from the book by Oleg Sergyevich Razumov, "Statistika," 2,300 copies, 184 pages]

[Text] The basic concepts, definitions and types of structure of data used in the organization of blocks of information in information processing computer systems (IVS) are considered. Attention is devoted to the theoretical problems of organization and storage of large blocks of data in IVS's, to the new methodological approach to the structural organization of data, to effective algorithms for managing blocks of data, and also to system organization of data and control in Unified System Computers.

The book is intended for engineers, programmers and other specialists, involved in the use of computer systems, and also may be used by instructors and students of VUZ's.

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ORGANIZATIONAL-LEGAL PROBLEMS OF AUTOMATED MANAGEMENT SYSTEMS

Moscow ORGANIZATSIONNO-PRAVOVYYE PROBLEMY ASU in Russian 1979 signed to press 22 Dec 78 p 2, 310-311

[Annotation and Table of Contents from book by a group of authors, I. L. Bachilo and Yu. A. Tikhomirov, editors, Nauka, 2,700 copies, 311 pages]

[Text] The monograph explores the legal problems in regulating management operations that use modern electronic computer technology. Practical proposals and recommendations are advanced for increasing the effectiveness of automated management systems (ASU).

The book was written by a group of authors, as follows: candidate in jurisprudence I. L. Bachilo: chapter I and (in cooperation with S. V. Katrich) chapter II; candidate in jurisprudence I. L. Brodskiy: chapter IV, section 3; doctor in jurisprudence A. B. Vengerov: chapter IX; doctor in jurisprudence V. G. Vishnyakov: chapter III; candidate in jurisprudence S. V. Katrich: chapter II (in cooperation with I. L. Bachilo) and chapter VIII; candidate in jurisprusence S. S. Moskvin: chapter VI; candidate in jurisprudence A. G. Ol'shanetskiy: chapter V, sections 1 and 2, and chapter VII; candidate in jurisprudence I. D. Tinovitskaya: chapter V, Sections 3 and 4; and candidate in jurisprudence V. V. Tolstosheyev: chapter IV, sections 2 and 3.

Joint editors: candidate in jurisprudence I. L. Bachilo and doctor in jurisprudence Yu. A. Tikhomirov

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PRINCIPLES OF CONSTRUCTION OF SECTOR AUTOMATED MANAGEMENT SYSTEM

Moscow OSNOVY SOZDANIYA OASU in Russian 1978 signed to press 14 Jul 78 pp 173-175

[Annotation and table of contents from the book by Vladimir Stepanovich Sinyak, Izdetel'stvo "Statistika," 10,000 copies, 174 pages]

[Text] On the basis of generalizations from experience with designing and incorporating OASU's [Sector Automated Management Systems], this work considers the principles of construction and structure of the OASU, questions of the development of functional subsystems and of the provision of portions of them through use of third generation computers. A methodology for evaluating the effectiveness of the OASU is presented, as are the stages of its creation and future prospects for the OASU's development.

The book is intended for specialists involved with the creation of OASU's, workers in the Ministries and departments and might be useful to students and graduate suudents of VUZ's [higher educational institutions] in relevant specialties.

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PROGRAMMING PROBLEMS TO BE SOLVED ON ANALOG COMPUTERS

Kiev PROGRAMMIROVAANIYE ZADACH DLYA RESHENIYA NA AVM in Russian 1978 signed to press 2 Dec 77 pp 2, 198-9

[Annotation and table of contents from the book by Vladimir Ivanovich Stul'nikov, Izdetel'stvo "Tekhnika," 8,000 copies, 200 pages]

[Text] A methodology for preparing various problems to be solved on analog computers (AVM) and general methods of programming are discussed. Special features and difficulties in the use of AVM's, methods for simplification, increasing the stability, accuracy and reliability of analog models are described. Methods of solving problems in optimization and the use of hybrid computer systems are considered. Examples are cited of programming concrete electrical engineering problems from the field of power transducer technology for solution on AVM's. The basic operational parameters output by AVM's are given. Intended for engineers and technicians, involved in programming and preparing problems for processing by AVM's and may also be useful for VUZ students in appropriate fields.

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SETTING UP DATA PROCESSING IN AUTOMATED ENTERPRISE MANAGEMENT SYSTEMS

Kiev TAKHNOLOGIYA OBRABOTKI DANNYKH V ASUP (Data Processing Technology in the ASUP) in Russian 1978 signed to press 4 Jul 78 pp 2, 173

[Annotation and table of contents of book by doctor in technical sciences Boris Boriskovich Timofeyev and candidate in technical sciences Valeriy Andronikovich Litvinov, Kiev, "Tekhnika," 6,500 copies, 176 pages]

[Text] This book is devoted to improving the efficiency, organization, and realization of technological data processing operations in ASUP's [Automated Enterprise Management Systems]. The distinctive features of the technological operations involved in data processing and operations systems of ASUP's are considered: methods of preparing, monitoring, and editing data; the organization of storage of the centralized information fund of the ASUP; techniques for processing files. An operations systems developed with due regard for the special features of data processing in ASUP's is described.

The book is intended for engineering-technical personnel engaged in the design and operation of automated management systems and may also be useful to students in the corresponding specializations at higher educational institutions.

The book was reviewed by candidate in technical sciences A. A. Chernykh. It was published in an edition of 6,500 by the editorial office for literature on power, electronics, cybernetics and communications of the Takhnika Publishing House. Z. V. Bozhko is head of the editorial office.

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STABILITY OF MAGNETIC MEMORIES

Moscow USTOYCHIVOST' MAGNITNYKH ZAPOMINA-YUSHCHIKH USTROYSTV (Stability Of Magnetic Memories) in Russian 1978 signed to press 3 Apr 78 p 2, 3-7, 9

[Annotation, introduction and table of contents from book by Viktor Lazarevich Volchek, Aleksandr Yur'yevich Gordonov and Aleksandr Aleksandrovich Deryugin, Sovetskoye "Radio", 7,100 copies, 96 pages]

[Text] This book is dedicated to problems of the stable operation of memories made of ferrite cores. The stability of memory operation is determined by the region of stable operation of the memory unit. The determining and influencing parameters of the memory unit are established. An analytical determination is made of the stable operation region, i.e., an interrelationship is established between the input and internal parameters of the memory unit for given limitations imposed on the output parameters. Certain factors are considered that affect the parameters of the excitation currents (input parameters) and the read-out signal parameters (output parameters).

The book is intended for engineers involved in designing memories, and may be useful to students and graduate students who specialize in the area of developing computers.

Introduction

The most important quality indicator of a memory (ZU) is its reliability, i.e., the property of the memory to fulfill the functions of recording, storing and reading out data, preserving its characteristics during the required time interval or the required operating time. The ZU reliability is evaluated quantitatively by the intensity of failures, as well as by the average time of faultless operation or operating time to the first failure [1].

Another ZU quality indicator is stability that characterizes the fundtioning of the device at a given moment of time for certain external conditions.

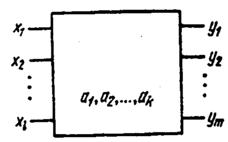

Fig. V.1. Determination of region of stable operation of the device

The region of stable operation of any device may be determined in the following manner. Let device (Fig. V.1.) be characterized by a finite number of internal parameters $a_1, a_2, \ldots, a_k$ (parameters of parts and components of the device). In the process of functioning, it is subjected to the effect of input (external) parameters $x_1, x_2, \ldots, x_l$ (for example, input signals, feed voltages, temperatures, etc.). The correctness of the functioning of the device is determined by its output (external) parameters $y_1, y_2, \ldots, y_m$ being within certain limits.

Each output parameter $y_i (i = 1, 2, \ldots, m)$ is a function of the internal parameters, the input parameters and time:

$$y_i = f_{1i}(a_1, a_2, \ldots, a_k; x_1, x_2, \ldots, x_l; t),$$

while at each given moment of time -- it is a function of internal and input parameters

$$y_i = f_{2i}(a_1, a_2, \ldots, a_k; x_1, x_2, \ldots, x_l).$$

We will assume that all internal parameters are determined and do not depend on the input parameters. In this case,

$$y_i = f_{3i}(x_1, x_2, \ldots, x_l).$$

By a region of stable operation (OUR) is meant a totality of points in the space of input parameters $x_1, x_2, \ldots, x_l$ in which all output parameters are within given limits. The quantitative evaluations of OUR are allowable relative deviations of input parameters from their nominal values $\varepsilon_1, \varepsilon_2, \ldots, \varepsilon_l$; in this case, the least allowable relative deviation (for example, ε_j) is chosen.

Obviously, various input parameters are characterized by various values of ε and by this criterion may be divided into several kinds. To analyze the possible kinds of input parameters, we will represent the OUR depending on some two kinds of input parameters at nominal values of the remaining ones. Such an analysis is used for the simplicity of graphical representation of the OUR, inasmuch as the representation of a three-dimensional OUR is not obvious and a four-dimensional (and greater) representation is, in general, impossible. A two-dimensional OUR is a cross section of a multidimensional OUR plane passing through a point, corresponding to a nominal mode, parallel to the plane of two parameters selected for the analysis.

One view of the cross section is shown in Fig. V. 2a. Each of the selected parameters (for example, x_1 and x_2) limits OUR on both sides. We will call them limiting parameters. The cross section shown in Fig. V.2b corresponds to the case when the OUR is limited only on one side when one of the parameters (for example, x_3) changes. Fig. V.2c shows a cross section of OUR when each of the parameters (for example, x_3 and x_4) limits the OUR on one side. We will call parameters of the x_3, x_4 type influencing parameters.

The nominal values of influencing parameters may be selected so that the OUR limits in determining parameter coordinates do not change for the entire range of possible values of the influencing parameters. This makes it possible in analyzing OUR to take into account only the determining parameters imposing the above-indicated limitations on the influencing parameters.

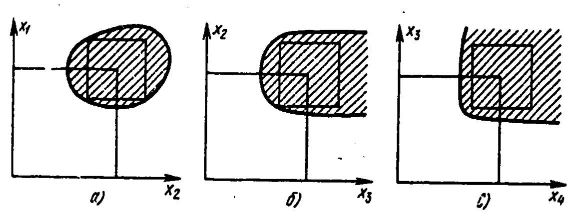

Fig. V.2. Section of an OUR by a place parallel to the plane of the two determining parameters (a) one determining and one influencing parameter (b) and two influencing parameters (c). We will note that the internal parameters of the device can also be determining and influencing. Those internal parameters, whose change in a wide range (greater than determined by specifications) does not lead to the change in the OUR limits, we will refer to as a category of noninfluencing ones and will generally exclude them from consideration.

Obviously, the change of one or several internal (determining) parameters may lead to a change in the OUR limits and to a change in one or several values of $\varepsilon_1, \varepsilon_2, \ldots, \varepsilon_l$. The determination of the interrelationship between the values of the internal parameters of the device $a_1, a_2, \ldots, a_k$ and the values of the allowable relative deviations of input parameters $\varepsilon_1, \varepsilon_2, \ldots, \varepsilon_l$ is one of the basic problems of designing the device. The solution of this problem is reduced to finding the nominal values of input parameters and their relative deviations depending upon the values of the internal parameters.

The problem of analyzing the stability of the operation of the device is related to the problem of determining its parametric reliability [2]. With a gradual change in internal parameters, there is, first, a reduction in allowable relative deviations in one or several input parameters and, later, the device becomes inoperative.

The methods for determining the OUR may be divided into analytical (calculated) and experimental. Analytical methods are used if the functioning of the device can be described by a system of equations that tie input, output and internal parameters together. In the majority of practical cases, especially when the number of input and internal parameters is great, it is difficult to determine analytical expressions. It is necessary then to take into account only a part of the determining parameters or make a number of assumptions that distort the real picture of the behavior of the device. It should be noted that usually the number of equations is smaller than the number of variables; therefore, the determination of the nominal parameter values and their relative deviations on the basis of analytical expressions is not single-valued.

At present, experimental methods are considered to be efficient for studying the OUR of complicated devices.

One of the methods is as follows. All input parameters, taking into account known limitations on their values, are given certain values within the OUR (average, if possible). Then relative deviations of each parameter are determined and the parameter with the least value of (the critical parameter) is found. Then, in one or another sequence, the nominal parameters of the remaining parameters are varied to increase the value of the critical parameter. Then the relative deviations of each parameter are determined anew, the critical parameter is found again, etc. The problem of determining the nominal value of the parameter is similar to the problems considered in the theory of self-tuning systems or in investigating operations.

This book is dedicated to the analysis of the operating stability of ZU made with magnetic memory components. The stability of ZU operation is studied by the OUR of the memory device, which is the basic ZU unit and determines the requirements for all other units.

Problems of designing and analyzing the OUR ZU memory units made with ferrite cores are considered in the works of many authors [3, 4]. This book generalizes and systematizes known information, and describes the results of papers in the area of designing ZU with ferrite cores.

The first chapter describes determining and influencing the input parameters of the ZU memory unit. An analytical determination of the OUR is made, i.e., the interrelationship is established between input and internal parameters for given limitations on the output parameters. Recommendations are made on selecting the values of influencing parameters. The OUR are analyzed depending on the variation in the determining (input and internal) parameters of the memory unit.

The second chapter of the book considers certain factors that affect the excitation current parameters (input parameters) and signal read-out parameters (output parameters). These parameters sometimes are not taken into account by ZU designers; however, their action directly or indirectly can lead to a change in the OUR of the memory unit made with ferrite cores.

The authors express their gratitude to prof. L. P. Krayzmer, doctor in technical sciences, for his remarks and advice that facilitated the improvement of the contents of this book.

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STOCHASTIC AND NONLINEAR PROGRAMMING IN AGRICULTURE

Yerevan STOKHASTICHESKOYE I NELINEYNOYE PROGRAMMIROVANIYE V SEL'SKOM KHOZYAYSTVE in Russian 1978 signed to press 8 Jun 78 pp 2, 142-143

[Annotation and table of contents from the book by Al'bert Bagarshakovich Saakyan, Izdatel'stvo Ayastan, 2,000 copies, 143 pages]

[Text] Annotation

An automated system for managing agriculture is an inherent part of the systems that are being developed on a Statewide scale, and is distinguished by a number of specific features. One of them is the dependence of agriculture on natural and climatic conditions that are of a probabilistic nature.

In this book, using specific examples from kolkhozes and sovkhozes throughout the republic, the author formulates and solves problems having to do with the optimum combination of sectors, the optimum composition of the machinery and tractor fleet and other factors, demonstrates the techniques for using the developed methods and models, and adduces the economic effectiveness of the proposed measures.

This book is intended for people who are developing and introducing ASU (automated management systems) in agriculture, scientific workers and the leaders of agricultural enterprises.

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