JPRS L/9408

24 November 1980

USSR Report

CYBERNETICS, COMPUTERS AND AUTOMATION TECHNOLOGY

(FOUO 17/80)

FBIS FOREIGN BROADCAST INFORMATION SERVICE

NOTE

JPRS publications contain information primarily from foreign newspapers, periodicals and books, but also from news agency transmissions and broadcasts. Materials from foreign-language sources are translated; those from English-language sources are transcribed or reprinted, with the original phrasing and other characteristics retained.

Headlines, editorial reports, and material enclosed in brackets [] are supplied by JPRS. Processing indicators such as [Text] or [Excerpt] in the first line of each item, or following the last line of a brief, indicate how the original information was processed. Where no processing indicator is given, the information was summarized or extracted.

Unfamiliar names rendered phonetically or transliterated are enclosed in parentheses. Words or names preceded by a question mark and enclosed in parentheses were not clear in the original but have been supplied as appropriate in context. Other unattributed parenthetical notes within the body of an item originate with the source. Times within items are as given by source.

The contents of this publication in no way represent the policies, views or attitudes of the U.S. Government.

APPROVED FOR RELEASE: 2007/02/08: CIA-RDP82-00850R000300050028-3

JPRS L/9408

24 November 1980

USSR REPORT

CYBERNETICS, COMPUTERS AND AUTOMATION TECHNOLOGY

(FOUO 17/80)

CONTENTS

HARDWARE

OPTICAL DATA PROCESSING

Leningrad OPTICHESKAYA OBRABOTKA INFORMATSIYA in Russian 1979 pp 2,3,33-35,61,67,74,85-91,92,103,107,116,138,143,155,163,171,187,197,205,206

[Annotation, table of contents, and excerpts from book edited by S. B. Gurevich, Order of Lenin Physico-Technical Institute imeni A. F. Ioffe, 500 copies, 207 pages]

[Text] Annotation

Reports presented at the Second All-Union School for Optical Data Processing, held in Gor'kiy in 1978, served as the basis of the present collection.

The material of the collection is devoted to various questions of optical data processing: the theory of analog coherent optical processors, the method of processing, space-time modulators and applications of optical methods to solve practical problems. Together with survey materials, the results of original investigations of authors are presented in the articles.

The collection gives specialists working in various areas of science and technology on data processing problems the possibility of becoming acquainted with new achievements in the area of optical data processing.

CONTENTS Page

[Excerpts]

UDC 621.391.156

PRINCIPLES OF THE GENERAL THEORY OF ANALOG COHERENT OPTICAL PROCESSORS. I.

[Article by E. I. Krupitskiy]

[Excerpt] Annotation. In the paper an attempt is made to examine all types of analog coherent optical processors from positions of a general mathematical description of realized data processing algorithms.

The present, first, part of the work contains an analysis of the problem, a selection of a method of describing the processors and a detailed examination of the most general properties of optical system linear operators, including with optical feedback. Nonlinear systems are to be examined in the second part of the book.

BIBLIOGRAPHY

1. Carlson, F. P., and Francois, R. E. Generalized Linear Processors for Coherent Optical Computers. TIIER, Vol 65, No 1, pp 13-22, 1977.

2. Korbukov, G. Ye., Kulikov, V. V., and Tsvetov, Ye. R. Optical Heterodyne Method of Correlational Image Processing. In the book: Holografiya i obrabotka informatsii (Holography and Data Processing). Leningrad, "Nauka," pp 51-68, 1976.

3. Kasasent, D. (USA). Coherent Optical Converters. In the book: Prostranstvennyye modulyatory sveta (Spatial Light Modulators). Leningrad, "Nauka," pp 18-41, 1977.

4. Kurpitskiy, E. I., Sergeyenko, T. N., and Yakovlev, V. P. Optico-acoustic radio signal spectrum analyzers. In the book: Golografiya i obrabotka informatsii. Leningrad, "Nauka," pp 106-124, 1976.

5. Vasilenko, G. I. Golograficheskoye opoznavaniye obrazov (Holographic Image Recognition). Moscow, "Sovetskoye radio," p 328, 1977.

6. Goodman, G. W. Possibilities of coherent optical data processing systems. TIIER, Vol 65, No 1, pp 37-48, 1977.

7. Jablonowski, D. P., and Lee, S. H. A coherent optical feedback system for optical information processing. Appl. Phys., Vol 8, No 1, pp 51-58, 1975.

8. De Santis, P., Gori, G., Guattary, G., and Palma C. Optical systems with feedback. Optica Acta, Vol 23, No 7, pp 505-518, 1976.

9. Markov, G. T., and Chaplin, A. F. Vozbuzhdeniye elektromagnitnykh voln (Excitation of Electromagnetic Waves). Moscow-Leningrad, "Energiya," p 321, 1967.

10. Sherkliff, W. Polyarizovannyy svet (Polarized Light). Moscow, "Mir," p 264, 1965.

11. Krasnov, M. D. Integral'nyye uravneniya (Integral Equations). Moscow, "Nauka", p 304, 1975.

12. Eguchi, R., and Carlson, F. Linear vector operations in coherent optical data processing systems. Appl. Opt., Vol 3, No 3, pp 687-694, 1970.

13. Krupitskiy, E. I. General solution of the problem of signal discretization. PROBLEMY PEREDACHI INFORMATSII, No 2, pp 98-103, 1975.

14. Gikhonov, A. N., and Arsenin, V. Ya. Metody resheniya nekorrektnykh zadach (Methods of Solving Incorrect Problems). Moscow, "Nauka," p 224, 1974.

UDC 535.317:681.3

NEW APPROACH TO OPTICAL ANALOG COMPUTER EQUIPMENT

[Article by Ye. S. Nezhenenko]

[Excerpt] Annotation. The principles of construction of analog optical computers, using controlled transparencies as the main elements, are examined. The main optical feature of such machines is the use of machine variable phase shift between two perpendicularly polarized light waves, arising as a result of induced birefringence, and also application of the principle of the time base of a luminous signal. It has been shown that in optical analog computers the realization of arithmetic and logical operations, nonlinear functional transformations and integro-differential space-time operations is possible. Examples are given of a set of analog optical computers for the solution of integral equations and equations in partial derivatives, and also for realization of an algorithm of stochastic approximation (an algorithm of adaptation).

UDC 535.317.2:681.332

HOLOGRAPHIC METHOD OF IMAGE DEPICTION IN SPATIALLY INCOHERENT MONOCHROMATIC LIGHT

[Article by O. I. Potaturkin and V. I. Khotskin]

[Excerpt] Annotation. A holographic method of data processing based on obtaining the correlation function of an input signal with pulsed response of the system to spatially coherent monochromatic light is examined in general form. An estimate is made of the signal-to-noise ratio in the case of application of a random phase mask, used to disrupt the spatial coherency of the laser beam. It is shown that the type of output signal does not depend on the longitudinal displacements of the holographic filter in the case of processing with the use of controlled transparencies as preliminary processing devices.

UDC 535.317.2:681.332

NONLINEAR PROCESSING OF OPTICAL SIGNALS WITH THE POSITIONAL CODING METHOD

[Article by Ye. S. Nezhevenko and O. I. Potaturkin]

[Excerpt] Annotation. The authors examine a method of carrying out complex computational procedures in coherent optical systems, based on a special representation of numbers in the form of optical signals and on the introduction of certain additional elements into known coherent optical processor circuits. In particular, the method assures realization of nonlinear operators, used in solving tasks of image recognition, and also entering nonlinear integral operations. Examples of the realization by means of the method of some widely distributed operators are given. The dimensions of the processed arrays and the computational productivity of the method are estimated. The results of experimental investigations are presented.

UDC 621.391.2

SERIES-PARALLEL METHOD OF IMAGE ANALYSIS IN A COHERENT OPTICAL PROCESSOR

[Article by B. I. Spektor and V. I. Khotskin]

[Excerpt] Annotation. A method of image analysis in a coherent optical processor is examined in the work. The essence of the method is that a parallel character of the calculations is realized on only one spatial coordinate, and the other is used to make a multichannel comparison (for example, sorting according to orientation or scale, or according to another parameter necessary during the realization of complex functionals or a syntactic approach to image recognition). Conducted theoretical and experimental investigations show that application of the method permits:

1) increasing the speed of the processing system; 2) increasing the precision of calculations by increasing the signal-to-noise ratio; 3) considerably expanding the range of invariance of the amount of filter response to input image displacement; 4) applying thick-layer emulsions with great diffractive effectiveness fof holographic filters; 5) solving normalization problems in a relatively simple manner; 6) using linear photoreceivers.

UDC 621.385:530.145.6:77

OPTICO-ELECTRONIC PROCESSOR FOR IMAGE RECOGNITION

[Article by V. I. Kozik, V. I. Litvintsov, Ye. S. Nozhevenko, and V. I. Khotskin]

[Text] Annotation. The main requirements for an optical processor for image processing are formulated. A description is given of an optico-electronic processor for image recognition, and its main characteristics.

Image recognition belongs to the class of problems in the solution of which optico-electronic processors can be used very effectively [1]. However, their wide use is restricted in practice by limitations flowing from distinctive features of optical processing methods. We will formulate the main requirements for an optical image processor that meets to a very great degree the goal of solving practical tasks.

1. The need for effective input of images in a processor. Nonfulfilment of this requirement sharply narrows the range of tasks solvable by the processor, limiting it to the recognition of images recorded on photographic material.

2. The possibility of realization of complex algorithms for image recognition. If only very simple decision functions can be calculated in a processor, for example, the function of mutual correlation of the image to be recognized and an etalon, such a processor will be ineffective, the quality of recognition is low and the class of recognizable images is very narrow.

3. The assurance of weak sensitivity of the calculation precision in a processor to phase distortions of its optical elements, the precision of its adjustment, tuning and installation (for mobile elements). The fulfilment of this point is especially important when the processor functions in severe conditions, for example, in the presence of vibration. In addition, it permits lowering the requirement for quality of the optical elements (and, consequently, reducing their cost), reducing the processor dimensions and increasing its speed.

4. Efficient input of etalons. The etalon is registered in the processor in a holographic filter and in the case of very widespread multi-alternative recognition a large library of filters is required, but if the etalon is previously unknown and must be formed in the process of recognition, then an inefficient filter carrier is altogether unacceptable.

The processor described below, which was created in the Institute of Automation and Electrometry, Siberian Department, USSR Academy of Sciences, was developed with consideration of the formulated requirements. Its

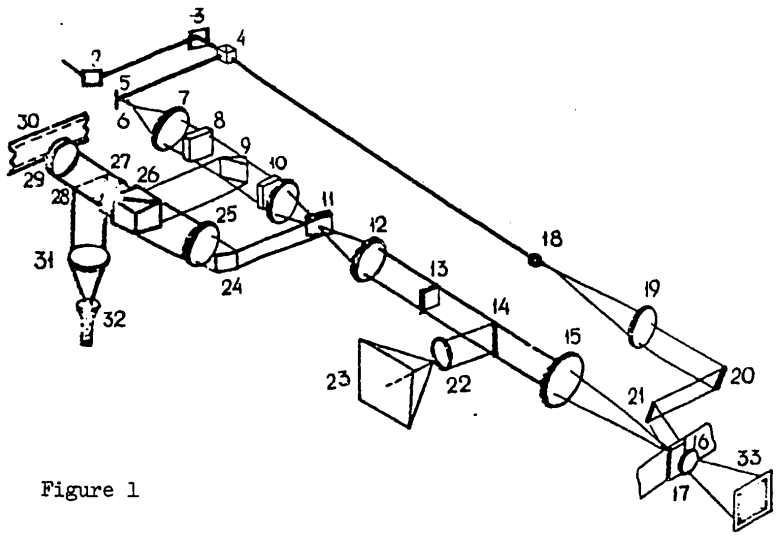


Figure 1

optical circuit is presented by Figure 1. There are three channels in the processor: the recording channel, the working channel and the reference beam channel. The recording channel assures input of the image from film 30 or tube 32 on controlled transparencies 10 and 13 through optics 29, 27, 31, 25 and 12 and light dividers 26, 9 and 11. In the working channel the image recorded on the controlled transparencies is processed and filtered. The laser beam 1 is collimated by collimators 6 and 7, the spatial coherency of the beam is disrupted by the rotating phase mask 8 and the spatially incoherent beam illuminates the plane of controlled transparency 10. The controlled transparencies 10 and 13 assure the preliminary processing of the image, and its Fourier transformation is projected by objective 15 on photothermoplastic filter 16. The cross-correlation function of the processed image and etalon recorded on the filter is projected by objective 17 on the target of the photoreadout device 33. In registering the etalon all the same operations are carried out as during recognition but, besides the working channel, the reference point channel is connected (elements 4, 18, 19, 20 and 21) and the photothermoplastic unit is transferred to the recording mode.

Let us examine in greater detail the work of separate units of the processor. Controlled transparencies of the PROM type, used in the processor, were described in detail in [2]. The image processing algorithms realized on controlled transparencies were presented in [3]. They all are reduced to a given method of outlining the image to be recognized. Of special

Interest is the realization in a partially coherent processor of the algorithm examined in [4]. The correlations derived for a coherent correlator are also preserved for the partially coherent, except that the processing does not relate to amplitude but to intensity, the sign (-) being formed through corresponding inclusion of the controlled transparencies (upravlyayemyye transparanty--UT). Let it be required for the image $f(x,y)$ to recognize a certain image $\phi(x,y)$ which is given by its contour $P(x,y)$. We will record on UT_1 the image $f(x,y)$ and on UT_2 the image $f(x,y) \times h(x,y)$, where $h(x,y) = \delta(x^2 + y^2 - \Delta^2)$ [such an operation can be obtained, for example, by displacement of the image on a circle with the radius $\Delta = 0$ by means of a wedge rotating in the frequency plane of the optical system for projection of the image $f(x,y)$. The etalon is executed in the form:

$$\phi(x,y) = \delta(s,n-\Delta) - \delta(s,n+\Delta)$$

where $[n(x,y), s(x,y)]$ is a coordinate system connected with the contour $P(x,y)$ [6].

Then in the processor the decision function is calculated:

$$R(x',y') = \iint_{\Lambda_1} f(x-x',y-y')dxdy - \int_{\Lambda_2} f(x-x', y-y')dxdy$$

where Λ_1 and Λ_2 are contours equidistant from the etalon contour, remote from it by the distance Δ. Thus the controlling transparencies in the partially coherent correlator assure execution of the recognition algorithms realizable in a coherent system.

The rotating phase mask in a coherent channel and the filter removed with the phase mask permit processing the image for intensity. The sensitivity of this kind of processing to phase distortion, displacements of elements, etc, was examined in [5], and we will only note that it is much lower than in the coherent case.

The dynamic filter of the correlator is made of photothermoplastic material which, as is known, has high resolution, good diffractive effectiveness, adequate sensitivity and the possibility of long storage of recorded information. Polyepoxylpropylcarbazole is used as a photoconductive layer of photothermoplastic (PTP) material, the PTP material is heated by joule heat evolved in a transparent electrode, the potential of the corona is ~ 6 kV, and the PTP material is irradiated with incoherent light before exposure.

The decision function is read out by television equipment consisting of a vidicon, a video signal processing unit and a monitor. The video signal processing unit permits maintaining high and low frequencies and removing information by means of a cell generator (L) without loss of signal-to-noise ratio. The starting information has dimensions of 625 x 625 elements (the television standard), after the cell generator is compressed to

16 x 16 elements. In that case the dimensions and position of the field of cells in the region of the decision function can be regulated by an operator.

Table 1 presents a diagram of the complete automatic work cycle of the processor. The total cycle time is 6 seconds. It can be reduced substantially (to 1-1.5 second) if pulsed image registration on a controlled transparency is introduced and the heating of the PTP material is dosed by the introduction of temperature feedback.

Table 1

Key: A - Etalon recording on UT
B - Filter recording on UT
C - Image recognition
1 - UT shorting
2 - UT erasure
3 - UT powering
4 - UT exposure
5 - PTP material illumination
6 - PTP heating
7 - Corona
8 - PTP exposure
9 - Readoff from UT and TV signal processing

Experiments on the recognition of test objects were conducted on the processor. Shown on Figure 2 are: (a) images to be recognized and (b) the section of the correlation field along a line passing through the coordinate of one of the objects to be recognized. The described experiment is illustrative. The determination of the precision characteristics of the processor, the probability of recognition of test objects, etc, will be the subject of further investigations.

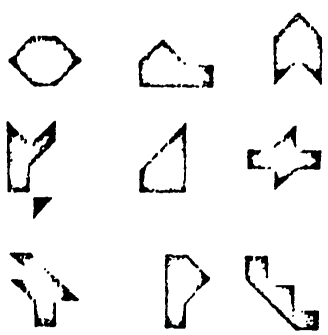


Figure 2a

Figure 2b

In conclusion we present a summary of the main processor characteristics:

Wave length of readout light	6328 mm
Type of controlled transparencies	PROM
Aperture of " "	30 mm in dia
Resolution of " "	10 lines/mm
Wave length of recording light	4400 mm
Processed optical signal	intensity
Focal distance of Fourier objective	600 mm
Reference point angle during hologram recording	15°
Filter size for PTP material	5 mm
Maximum size of etalon (pulsed filter)	30 mm in dia
Readout and processing of decision function: vidicon readout, frequency processing of video signal, compression of information by cell generator	
Time of recognition cycle of a single image with etalon recording	~6 seconds

BIBLIOGRAPHY

1. Vasilenko, G. I. Gologaficheskoye opoznavaniye obrazov (Holographic Image Recognition). Moscow, 1977.

2. Kotlyar, P. Ye., Nezhevenko, Ye. S., and Fel'dbush, V. I. Space-time light modulator for image input into coherent optical systems. In the book: Prostranstvennyye modulyatory sveta (Spatial Light Modulators), Leningrad, "Nauka," pp 113-118, 1977.

3. Kotlyar, P. Ye., Nezhevenko, Ye. S., Oparin, A. N., and Fel'dbush, V. I. Differential controlled transparencies for optical information processing. In the book: Opticheskaya obrabotka informatsii (Optical Data Processing), Leningrad, Physico-Technical Institute, pp 155-162, 1979.

4. Nezhevenko, Ye. S., and Potaturkin, O. I. Realization of a dispersion algorithm for recognition by methods of coherent optics. AVTOMETRIYA, No 5, pp 36-40, 1979.

5. Potaturkin, O. I. Khotskin, V. I. Holographic method of image processing in spatially incoherent monochromatic light. In the book: Opticheskaya obrabotka informatsii. Leningrad, Physico-Technical Institute, pp 61-66, 1979.

UDC 330.5:535.39

SEPARATION OF SPACE-FREQUENCY CHARACTERISTICS BY MEANS OF AN OPTICO-ELECTRONIC SYSTEM OF SPACE-FREQUENCY SPECTRA DISCRETIZATION

[Article by V. A. Kozinchuk and A. A. Feoktistov]

[Excerpt] Annotation. A description is given of a coherent optical system intended for the formation of the space-frequency spectrum of image fragments. On the basis of analysis of space-frequency spectra, space-frequency characteristics were established which were subjected to complex classification processing by computer.

UDC 330.5:535.39

ESTIMATING THE ACCURACY OF MEASUREMENT OF COORDINATES OF SPACE PHOTOGRAPHIC IMAGE FRAGMENTS

[Article by A. I. Balabanov, A. G. Nikolayev, and A. A. Feoktistov]

[Excerpt] Annotation. Within the framework of a known approach to signal separation on a background of additive Gaussian noises a theoretical analysis is made of the question of the limiting accuracy of measurement of the coordinates of reference points on space photographs obtained by scanning systems.

UDC 535.4.004.14:681.14

SOLUTION OF HETEROGENEOUS LINEAR INTEGRAL EQUATIONS OF THE SECOND KIND IN AN OPTICAL PROCESSOR

[Article by A. D. Auslender, G. N. Vishnyakov, G. G. Levin and B. M. Stepanov]

[Excerpt] Annotation. The authors examine the possibility of solving heterogeneous linear integral equations of the second kind in a coherent optical processor by the approximation method. To fulfil an iterative process it is proposed to use a closed optical circuit with feedback. Experimental results are presented which confirm the possibility of creating an efficient optical processor to solve integral equations.

UDC 535.317:681.3

COHERENT OPTICAL SYSTEMS WITH FEEDBACK FOR IMAGE PROCESSING

[Article by V. K. Sokolov and A. F. Malyy]

[Excerpt] Annotation. The equipment and working principles of coherent optical image processing systems are examined. In them optical feedback is used to increase the flexibility of the optical processors and expand the circle of problems solved by them. Operations in image processing performed by means of optical processors with feedback are analyzed.

UDC 621.391.156

USE OF OPTICAL FEEDBACK FOR IMAGE PROCESSING AND SOLUTIONS OF INTEGRAL EQUATIONS

[Article by V. B. Astaf'yev]

[Excerpt] Annotation. The article examines the possibilities of equipment with optical feedback for image processing and the solution of integral equations. The transformation made with the optical device is determined by the kind of operator of the feedback circuit. The possibility is shown of outlining images with a regulated parameter of outlining, synthesis of an A. N. Tikhonov filter (in particular, a Vinarov filter), and the solution of Friedholm equations of the second kind. To reduce the requirements for length of coherence of the light source, a holographic method of summing luminous fluxes which have passed a different number of times through the feedback circuit.

UDC 535.8:535.241.13

STUDY OF PHYSICAL PROCESSES OF DATA RECORDING AND LIGHT DIFFRACTION IN LAYERED STRUCTURES BASED ON ELECTROOPTICAL CRYSTALS

[Article by M. P. Petrov, A. V. Khomenko, V. I., Marakhonov, and V. I. Fel'dbush]

[Excerpt] Annotation. The characteristics of transmission of space and time frequencies of a new layered structure based on $Bi_{12}SiO_{20}$ are investigated. An installation for the real-time investigation of layered structures of electro-optical photoconductors is described. The possibility of using such an installation to simulate some optical data processing is shown.

UDC 621.378.9

DIFFERENTIAL CONTROLLED TRANSPARENCIES FOR OPTICAL DATA PROCESSING

[Article by P. Ye. Kotlyar, Ye. S. Nezhevenko, A. N. Oparin, and V. I. Fel'dbush]

[Excerpt] Annotation. It is shown that by means of controlled PROM transparencies it is possible to expand the class of operations on images performed in optical systems by including nonlinear operations in it.

UDC 535.17:681.3:778.33

TRANSMISSION CHARACTERISTICS OF AN X-RAY PROJECTION MICROSCOPE AND POSSIBILITIES OF INCREASING ITS EFFECTIVE RESOLUTION

[Article by V. F. Relin and V. K. Sokolov]

[Excerpt] Annotation. Distinctive features of image formation in an X-ray projection microscope are examined and factors limiting its resolution are analyzed. Since the main factor worsening resolution in an X-ray image is the finite dimensions of the used X-radiation source, to increase the effective resolution of X-ray microscopes it is proposed to use a posteriori optical data processing directed toward compensation of the influence of the extent of the source. Analytical expressions are presented for the transmission characteristics of a microscope for two particular cases. It is concluded that it is necessary to use complex correcting filters.

UDC 535.317

OPTICAL COHERENT CORRELATORS INVARIANT TOWARD INPUT SIGNAL DEFORMATIONS

[Article by G. A. Gavrilov and S. Yu. Kulikovskiy]

[Excerpt] Annotation. The article presents a survey of work on optical coherent correlators invariant toward input signal deformations. The principles of space-dependent filtration with conversion of coordinates and the principles of correlator creation are examined. A brief analysis of the proposed circuits is given and their possibilities and shortcomings are reviewed.

UDC 621.391.822

ON COMPARISON OF THE SENSITIVITY OF ORDINARY PHOTOGRAPHIC REGISTRATION AND HOLOGRAPHY

[Article by V. B. Konstantinov]

[Excerpt] Annotation. The sensitivity and information capacity of a hologram are examined with consideration of noises. Ordinary photographic registration and holographic are compared. It is shown that the assertion that the holographic method in some cases can be more sensitive than ordinary photography is in the general case incorrect.

UDC 535

HIGH-SPEED PHOTOGRAPHIC HOLOGRAM PROCESSING

[Article by V. D. Petrov and T. B. Yermanova]

[Excerpt] Annotation. The specifics of processing in high-speed developers [skorostnoy proyavitel'--SP] are examined. On the basis of the theory of extreme experiment planning the diffractive effectiveness of Fourier holograms registered on LOI-2 photographic plates was optimized. An optimized composition of the high-speed developer SP-4 was otained as a result of the experiment.

[404-2174]

2174
CSO: 1863

ADVANTAGES OF NEWLY DEVELOPED OPTICAL ELECTRONIC MEMORY UNIT

Minsk PROMYSHLENNOST' BELORUSSII in Russian No 7, 1980 p 74

[Article by V. Pilipovich, S. Shmatin, and A. Yesman: "Optical Electronic Storage Unit"]

[Excerpt] The high-speed memory units used in current computers have inadequate storage capacity and are very expensive. But the memory units with large storage capacity are slow. The ideal memory system would consist of just one storage unit with high speed, large capacity, and low specific cost. The capacity of such a memory unit is estimated at 10^{10}-10^{13} bits with a data retrieval time in the 10^{-6} second range. Unfortunately, building such a unit today is an extremely complex matter.

Among the new principles investigated recently for the purpose of solving the storage problem, the most promising are optical electronic memory units with by-element data recording, that is, recording by bit and by page (hologram). The schematic diagrams and functioning of memory units based on these principles differ significantly from one another. The first-mentioned type uses only the directivity of a light beam, while the second type of unit (holographic) uses the coherence of a laser beam and its capability of spatial modulation.

An original optical electronic device for storing large arrays has been invented at the Institute of Electronics of the Academy of Sciences Belorussian SSR. The holographic data recording principle is based on a photosensitive layer that fixes an interference picture created by two coherent waves: one reflected from the information object (or passing through it) and an auxiliary, reference wave. The picture fixed on the photographic film, which contains complete information on the wave reflected from the information object, is the hologram. When it is illuminated by the reference beam the image of the object is reproduced.

Use of this principle in an optical electronic memory unit affords the following advantages:

1. High density of data recording because of the shortness of the light wave;

2. The possibility of reading information in the form of arrays (pages of 10^5-10^6 bits), which greatly increases the productivity and data feeding speed of the computer;

3. High noise resistance, owing to the redundancy of the mechanism of holographic recording (information about each part of the object is recorded in the form of an interference picture on the entire surface of the photographic plate, which makes the hologram insensitive to microdefects such as dust, scratches, and the like);

4. Combining storage and logical processing functions in one unit, which permits associative data retrieval;

5. Reduction in requirement for precision of alignment of particular elements and the optical system of holographic devices compared to conventional optical memory units.

11,176
CSO: 1863

UDC 681.32:519.713

PROCEDURE FOR SYNTHESIS OF ASYNCHRONOUS PROGRAMMED LOGICAL MATRIX AUTOMATA

Riga AVTOMATIKA I VYCHISLITEL'NAYA TEKHNIKA in Russian No 4, 1980, pp 23, 30-31

[Article by E. A. Yakubaytis, Ye. S. Bul', E. E. Lange, I. G. Lemberskiy, G. F. Fritsnovich, and V. P. Chanenko]

[Excerpts] Programmed logical matrices (PLM) are finding wide application as an elementary base of discrete structures and systems. This is explained by such properties of them as simplicity of the circuitry and a high rate of execution of logical transformations, and also a relatively low cost, determined by the technological level and mass production [1,2]. For maximum utilization of the natural effect it is advisable to construct synchronous PLM discrete devices.

Examined in the present article is the synthesis of asynchronous finite automata with consideration of distinctive features of their PLM realization, which presents the following requirements of the logical structure of an automaton to be synthesized: 1) the structure to be synthesized must be resistant to dangerous contests at any finite correlations of the delay times of different logical elements; 2) the number of artificial delay elements introduced to eliminate contests must be minimal; 3) the quality criterion of the structure to be synthesized must be the PLM area (see figure 1) necessary for realization of the automaton to be synthesized. It is equal to $p_o \times (2n_o + m_o)$, where p_o, n_o and m_o are the numbers of intermediate, input and output lines respectively. On a single PLM a two-level combination circuit can be realized, one describable by the DNF system $m \leq m_o$ of Boolean functions of $n \leq n_o$ variables and containing $p \leq p_o$ members. If the indicated PLM parameters are not given, synthesis of the automaton consists in finding a structural representation of it in the form of a DNF system which requires for its realization a single PLM with a minimum area or close to that. If the parameters are given, however, synthesis is reduced to the construction of a circuit with a minimum number of PLM or close to it.

Conclusion

The main distinctive feature of the proposed procedure is the purposeful construction of the logical structure of an asynchronous automaton being synthesized in the form of a DNF system of Boolean functions having the least number or a similar summary number of different members with subsequent realization of the automation to be synthesized on one PLM, executed in the form of an ordered large-scale integrated circuit. For the case where such a realization is not possible, it is proposed to use different methods of decomposing the constructed DNF system which permit curtailing the number of PLM used to realize it.

The proposed procedure permits breaking synthesis down into a number of successive solvable formal tasks and creating for their solution various algorithms characterized by labor-intensiveness of the calculations and the quality of the obtained results. The totality of all those algorithms forms a basis for the creation of an automated synthesis system which permits forming from those algorithms for the solution of particular problems various synthesis procedures and assures the effective construction of logical structures of asynchronous PLM automata when there are limited resources of machine time and volume of main computer storage.

BIBLIOGRAPHY

1. Yakubaytis, E. A. Programmed logical automaton. AVT, 1975, No 5, pp 1-6.

2. Yakubaytis, E. A. Synthesis of the structure of a programmed logical matrix. AVT, 1976, No 4, pp 1-10.

3. Lemberskiy, I. G., Fritsnovich, G. F., and Chapenko, V. P. Method of synthesis of asyndhronous finite automata based on programmed logical matrices. In the book: Mikroprotsessory (Microprocessors). Riga, Zinatne, 1975, pp 181-184.

4. Lemberskiy, I. G., Fritsnovich, G. F., and Chapenko, V. P. Coding internal states of an asynchronous finite automaton with consideration of its programmed logical matrix realization. AVT, 1976, No 4, pp 11-12.

5. Yakubaytis, E. A., Fritsnovich, G. F., and Chapenko, V. P. Realization of an asynchronous finite automaton based on programmed logical matrix. In the book: IFAK simpozium "Diskretnyye sistemy" (IFAC Symposium on "Discrete Systems"), Vol 2, Dresden, 1977, pp 170-180.

6. Yakubaytis, E. A. Logicheskiye avtomaty i mikromoduli (Logical Automata and Micromodules). Riga, Zinatne, 1975, 259 pages.

7. Lemberskiy, T G., and Fritsnovich, G. F. Distinctive features of the coding of internal states of an asynchronous finite automaton during realization on a PLM basis. In the book: Teoriya avtomatov i yeye prilozheniya. Sintez avtomatov s perestraivayemoy strukturoy. Tez. dokladov IV sov-bolgar. seminara (Theory of Automata and Its Application. Synthesis of automata with adjustable structure. Summaries of Reports Presented at the Soviet-Bulgarian Seminar). Riga, Zinatne, 1977, pp 41-76.

8. Yakubaytis, E. A., Gobzemis, A. Yu., Petrenko, A. F., and Fritsnovich, G. F. Synthesis of asynchronous finite automata. IZVESTIYA AN SSSR. TEKHNICHESKAYA KIBERNETIKA, 1972, No 6, pp 139-149.

9. Lange, E. E. Automaton minimization with consideration of its PLM realization. In the book: Trudy V mezhdunarodnogo seminara "Prikladnyye aspekty teorii avtomatov." Proceedings of the Fifth International Seminar on "Practical Aspects of the Theory of Automata." Vol 1. Varna, 1979, pp 245-252.

10. Lemberskiy, I. G. Reduction of the number of DNF members in the coding of internal states of an asynchronous automaton based on a programmed logical matrix. AVT, 1979, No 2, pp 59-65.

11. Fritsnovich, G. F. Coding of internal states of asynchronous finite automata with a P-code of minimum length. In the book. Teoriya konechnykh avtomatov i yeye prilozheniya, No 1, 1973, pp 23-34 (Riga, Zinatne).

12. Fritsnovich, G. F. On the use of coloration of the apices of graphs in minimization of systems of Boolean functions. In the book: Trudy III mezhdunarodnogo seminara "Prikladnyye aspekty teorii avtomatov, Vol 1, Varna, 1975, pp 193-204.

13. Hemel, A. The PLA, a different Kind of ROM. ELECTRONIC DESIGN, 1976, No 1, pp 78-84.

14. Bul', Ye. S. Disposition of a combined PLM circuit with consideration of decomposition properties of switching functions. In the book: Trudy V mezhdunarodnogo seminara "Prikladnyye aspekty teorii avtomatov", Vol 1, Varna, 1979, pp 149-158.

[413-2174]

2175
CSO: 1863

UDC 621.318

STABILITY OF FLAT MAGNETIC DOMAINS

Moscow AVTOMATIKA I TELEMEKHANIKA in Russian No 8, 1980 pp 151-161

/Articly by N. P. Vasil'yeva, V. S. Semenov (Moscow): "The Stability of Flat Magnetic Domains"/

/Excerpts/ The minimum dimensions of stable flat magnetic domains (PMD's), the conditions of the change in the dimensions and the collapse of flat magnetic domains and the intensities of propagation fields are determined on the basis of the study of the energy ratios of the domain in an environment with inverse magnetization.

The research, which was aimed at the investigation and development of new types of memory units, which increase the efficiency of data processing systems, led to the development of memory units on flat magnetic domains. These memory units, which are designed first of all for the peripheral devices of mini- and microcomputers, in a number of countries are now going through the stage of preparation for large-series production. They are notable for the simplicity of the integrated technology, a potentially low cost and high reliability, which is the result of the use of a continuous magnetic medium, which is not divided into discrete components and in which variable controlled domains serve as the carriers of the data. The medium of the flat magnetic domains is a thin magnetic polycrystalline film with monoaxial anisotropy, in which the magnetization and the axis of light magnetization lie on the surface of the film.

When developing and producing memory units made from flat magnetic domains it is necessary to solve a number of physical and technical problems, which involve the determination of the minimum dimensions of the stable domains and the finding of the critical values of the intensities of the controlled fields, since these intensities determine the means of controlling the shift of the domains and the main parameters of the memory units made from flat magnetic domains.

The minimum dimensions of stable flat magnetic domains, the conditions of the change in the dimensions and the collapse of flat magnetic domains and

the intensities of the propagation fields are determined below on the basis of the study of the enery ratios of the domain in a medium with inverse magnetization.

This work is based on a new model of the charged wall of flat magnetic domains and is a development of works /1, 2/

Conclusion

The ratios obtained in the work make it possible to determine the maximum geometric dimensions of the individual components of a magnetic matrix (the channels of controlled conductors and others) with allowance made for the parameters of the magnetic tape carrier of the data, which facilitates the task of constructing memory units with a high information density. Moreover, a knowledge of these ratios should be of assistance when elaborating new principles of the control of flat magnetic domains, particularly when creating magnetic matrices with stabilizing local magnetic fields.

BIBLIOGRAPHY

1. Boyarchnkov, M. A.; Vasil'yeva, N. P., and Rozental', Yu. D., "Logicheskiye ustroystva na magneticheskikh sredakh s upravlyayemym dvizheniyem domenov" /Logic Devices Made From Magnetic Mediums With Controlled Motion of Domains/, "Energiya", 1978.

2. Vasil'yeva, N. P., and Semenov, V. S., "Parameters of Flat Magnetic Domains and Structures of Memory Matrices," "Tekhnicheskiye sistemy upravleniya i voprosy ikh nadezhnosti" /Technical Systems of Control and Questions of Their Reliability/, "Nauka", 1980, pp 91-95.

3. Middelhoek, S., "Domain Walls in Thin Ni-Fe Films," JOURNAL OF APPLIED PHYSICS, Vol 34, 1963, pp 1054-1059.

4. Battarel, C. P.; Morille, R., and Nori, J. P., "Flat Domain Propagation Mechanism in a Simplified Shift Register Structure With Magnetoresistive Read-Out," IEEE TRANSACTIONS ON MAGNETISM, Vol MAG-13, 1977, pp 1302-1304.

5. Baldwin, J. A., Jr., "A Method for the Measurement of Domain Wall Energy Density in Thin Magnetic Films," JOURNAL OF APPLIED PHYSICS, Vol 40, 1969, pp 432-433.

6. Spain, R. J., "Controlled Domain Tip Propagation," JOURNAL OF APPLIED PHYSICS, Vol 37, 1966, pp 2572-2583.

7. Sanders, I. L., and Collins, A. J., "Domain-Walls Energy Measurements in Ni-Fe-Co Folms," JOURNAL OF APPLIED PHYSICS, Vol 48, 1977, pp 1727-1729.

/21-7807/

7807

CSO: 1863

UDC 681.327.6

PROMISING PERIPHERAL MAGNETIC DISK MEMORIES FOR MINI-COMPUTERS

Moscow PRIBORY I SISTEMY UPRAVLENIYA in Russian No 6, 1980 pp 13-15

[Article by N. Botev, supervisor of comprehensive IVT program, B. Tsonev and L. Yordanov (Bulgaria)]

[Text] Computer technology (EVT) is currently expanding into various fields of the national economy. For most cases of EVT application, providing computer complexes with the maximally possible high-capacity magnetic disk memories is a knotty problem.

The characteristics are given below of magnetic cassette memories (Table 1) and floppy disks (Table 2) which have successfully passed combined tests in manufacturing countries and have received classification numbers in SM EVM and YeS EVM. These memories, however, no longer satisfy the continuously increasing requirements of mini-computer complexes as concerns capacity, reliability and operating conditions. In this article the authors have tried to set forth their views on magnetic disk memories (NMD) which are promsiing for SM EVM.

In spite of the indisputable successes achieved in the development of new data storage devices, research shows that in the coming decade peripheral memory devices (VZU) on moving magnetic media will retain their front-running position in computer technology. This is due to the possible reuse of magnetic media, the lack of need to duplicate information for storage, the as yet unexhausted possibilities for increasing data density and the data exchange rate, and the low cost of storage per information bit. From Table 3 [1, 2] we can see that NMD with moving heads can store information in a system one order less expensively than VZU using charge-coupled devices (PZS) and more than two orders less expensively than VZU using cylindrical magnetic domains (TsMD). NMD market watchers feel that in spite of the constant reduction in VZU costs, the current relationship between the cost of storage of one bit for NMD, PZS and TsMD will remain steady until 1985.

The world market of NMD with moving heads is extremely diverse. We believe that it is necessary to consider certain factors in determining which of them are promising: existing trends in NMD development on the world scale; satisfaction of user (system) requirements and effective standards;

necessary technology; field of application of the computer complexes.

Trends in the Development of NMD with Moving Heads

Some investigators of the world computer technology market divide NMDs into 12 categories (Table 4) [3]. By analyzing the tabular data we can see that those categories having the largest amount of marketing with a clear tendency toward its increase are the most promising.

Promising NMD are among the third and fourth generation devices and are realized using advanced technology which includes the use of servo-information and information modules.

Table 1
Replaceable cassette-type magnetic disks

Parameter	SM-5400 (Bulgaria)	SM-5401 (Poland)
maximum capacity, Mbits	50	
exchange rate, kbyte/sec	180, 312	312
Avg. data acess time, ms	50	40
Speed, rpm	1500, 2400	2400
number of tracks	204	
number of heads	4	
data media:		
replaceable cassettee	YeS-5269-01	MERA 847
permanent disk	Yes	
MTBF, hrs	2,000	
full operating time, bits	10^{10}	
interface	SM MM EVM 007-76	

The most substantial feature of third-generation NMDs is the use of servoinformation which was previously recorded on disk media to control the position of the read/write heads. When a memory contains several disks (e.g., 12), it is advisable to set aside one surface specially for input of servoinformation. This is advantageous because the servosurface occupies about 5 percent of the useful surface of the package. This setting aside of surface is envisaged in NMDs in categories 2, 4-6, 8 and 9. For mini-NMDs, however, an average of at least two disks is required and the servosurface occupies 25 percent of the media's useful surface, i.e., its use is not advantageous. In this circumstance servoinformation is

recorded in the initial zone of each sector of each track and an all-purpose read/write head is used. With this method, the inefficient use of useful media surface is reduced by another five percent.

The use of servoinformation recorded on the medium enables us to sharply increase track density from 8 (which is the maximum for second generation NMDs) to 24 per millimeter or more for NMD of subsequent generations. Furthermore, the effect of temperature is reduced, interchange of information media is facilitated, reliability is increased. The reliability of data exchange is increased by using new methods of data encoding such as modified frequency modulation and group encoding, as well as error--correcting codes.

The use of information modules is inherent in fourth generation NMDs. The carrier, coated with a special lubricant, and the head (sometimes with a positioner) are placed in an hermetically sealed module in these NMDs. These heads are several times softer than third generation memory heads. They freely rise from and descends onto the carrier surface without damaging it. This increases NMD resistance to the environment and nearly eliminates the problem of interchangeability. Furthermore, in fourth generation NMDs data access time is reduced by incorporating two heads placed on the same support lever and the use of fixed heads above the carrier surface.

The basic parameters which describe third and fourth generation NMDs are shown in Table 5.

NMD User Requirements

Traditional NMD user requirements chiefly boil down to increased capacity and exchange rate and reduced data access time. Furthermore, we know that the predominant cost in this computer system (about 30 percent) is for programming support. Thus when considering the connection of new NMDs to a given system, it is especially important for the user to assess the program compatibility of the new NMD with the operating system that controls his computer complex.

If is usually considered acceptable if changes in the operating system reduce to the addition of driver subroutines for a specific memory in a specific operating system. Updating of the operating system is facilitated if the memory capacity can be increased by increasing the number of tracks while retaining the data exchange rate and their arrangement in the NMD.

Meeting the Requirements of Effective Standards

When SM computers were designed, special attention was given to the study of the set of technical standards documents. For technical devices (TS) several documents were created to govern general technical specifications, methods of testing, requirements of ergonomics and industrial esthetics,

program compatibility, operating reliability, etc.

Table 2
Floppy Disk Memories (NGMD)

Parameter	YeS-5074 (Bulgaria)	MF-3200 (Hungary)	PLx450 (Poland)
Maximum capacity, Mbits	3.2	3.2	4 x 3.2
Exchange rate, Kbits/sec	250	250	250
Time, ms:			
shift to next track	10	10	--
press down head	10	25	30
damping of head	40	40	90
Speed, rpm	360	360	360
Number of:			
mechanisms/housing	1	1	2
head/mechanism	1	1	1
tracks	77	77	77
Medium:			
floppy disk	IBM "Diskette"		
media surfaces used	1	1	2 (media must be turned to use other side)
Interface	MM CM EVM 010-77		--
Reliability, hrs	2000	1000	2000
Full time, bits	10^9	10^9	10^9

The documents in effect establish the following requirements for technical hardware, according to the specific conditions under which the computer complexes of the system operate: ability to work in non-air-conditioned rooms, possibility of being built in according to MEK requirements; simplicity of maintenance, high reliability; standardized and unified designs.

Necessary Technological Conditions

For serial production of NMD, advanced technology must be created and assimilated in parallel; this involves great labor and material expenditures. Also typical of NMDs is that they become obsolete in five or six years because of the continuous improvements made in digital magnetic recording technology and varying requirements of computer systems. Reduction in media cost is also very important for minicomputer NMDs.

These contradictory requirements may be successfully considered by development of a series of devices with standardized mechanical design and electromechanical subassemblies. In mini-NMD primarily used in media and read/write heads, high-capacity NMDs have been developed and assimilate in production.

Furthermore, using new and improved methods of data encoding it is possible, while retaining former characteristics of the head and media, to increase memory capacity by several factors. The density of remagnetization is not altered. This method is used in NGMD (see Table 4, categories 10-12).

Table 3. Cost of storage of one bit for various VZU [1,2]

VZU	memory model	maximum capacity		cost of storage per bit, ¢
		each device Mbyte	in configuration, Mbyte	
NMD with moving heads	IBM 3340	69.9	559.1	3.4×10^{-3}
	Memorex 601	75	600	1.8×10^{-3}
	IBM 3350-A2	317	10,144	1.4×10^{-3}
	Telex 6316-1	317	5,072	0.7×10^{-3}
NMD with fixed heads	Alpha Data 80-512	9.6	—	0.03
	Amp. Comp. 8530/256	9.6	—	0.03
	DDS 8408-8	9.6	—	0.04
PZS peripheral memory	Alpha Data SS Disk	0.128	1.024	6.87
	Storage Technology STC 4305	11	45	0.1
TsMD peripheral	Rockwell POS/8 memory	0.0128	0.102	0.97
	TI Terminal model 765	0.0115	0.2	1.2

At the present stage, it may be asserted that third-generation NMD technology is being assimilated in CMEA countries. This will enable further improvements in NMDs for minicomputers to be made.

Fields of Application of Computer Complexes

For computer complexes designed on the basis of large computers, NMDs with moving heads may theoretically be standardized and one type of memory be used for all computer configurations. This is because operating conditions of TS in the given case are roughly identical to conditions of a computing center. For computer complexes with minicomputers, this approa[illegible] is difficult because of the wide diversity of fields of application, each of which has specific requirements. Thus in selecting NMDs for minicomptuers it is necessary to consider the field of application of the specific computer complex. In this respect, four groups of NMDs can be identified.

For inexpensive, compact, all-purpose computer systems working under normal climatic conditions, NMD of categories 2, 4, 7 &8 should be used.

For large information systems used in air-conditioned rooms, it is advisable to use NMDs of categories 3-6 and 9.

For data preparation and input devices in computers and for microcomputers it is effective to use NMDs of categories 1, 10-12.

Table 4. Distribution of NMDs with moving heads by categories

NMD category	# devices delivered in 1976, thou. units	annual profit from use (%)	delta annual profit to 1980 (%)
NMD with rigid media			
1. NMD in removable cassette, 12 Mbyte	85.5	21.6	-4.1
2. NMD in removable cassette, over 12 Mbyte	2.2	1	+71.4
3. NMD in removable cassette, 29-58 Mbyte	3.1	6.6	-7.5
4. Disk memory modules, 25-80 Mbyte	7.9	2.5	+70.4
5. NMD in removable packets, over 100 Mbyte	29.6	32.6	-15
6. NMD on information modules, 35-70 Mbyte	17.5	12.6	-36.8
7. NMD in fixed disks, 12 Mbyte	17.3	4.3	+44.4
8. NMD in fixed disks, 12-200 Mbyte	—	—	+118.6
9. NMD in fixed disks, 200 Mbyte	7	10.8	+52
Total NMD with rigid media	—	91.9	+12.1
NMD with flexible media			
10. NMD, 8 in., one side	198.3	8.1	+25.8
11. NMD, 8-in., two sides	0.1	-	+147.5
12. NMD, 5.25 inch	1	-	+87
total NMD with flexible media	-	8.1	+41.4
Total NMD	--	100	+15.3

Table 5. Basic parameters of 3rd and 4th generation NMDs

Technology, NMD category	NMD capacity Mbyte/spindle	Rate of data exchange, kbyte/sec	Data access time, ms
servosurface: cat. 2, 4	20,50,80	806/1200	40
cat. 5	100,200,300	806/1200	35
Distributed servo-information:			
category 1	5	512.5	55
category 2	13,26,40	655	40
	56	762.5	40
information module:			
category 6	35,70,14	885	25
category 8	25,50,75	885	30
category 9	317	1200	35
	571	1859	35

Table 6. Promising groups of memories for mini-computers

NMD group	capacity, Mbyte	Data exch. rate, kbyte/s	Mean data access time, ms
cassette NMD	12,24,48	180-806	50
disk modules:			
replaceable	25,50,80	806/1200	40
permanent	25,50,75	806/1200	35
floppy disks	0.4; 0.8; 1.6	16/32/62	—

For harsh operating conditions (wide range of temperature and humidity, dusty atmosphere, etc.), NMDs of categories 4, 7 and 8 are recommended.

Conclusion

Bearing in mind the above notions, the developing needs for mini-computer peripheral memories can be profitably met with three groups of NMDs (Table 6). These memories meet the requirements of modularity and operating conditions, and furthermore, make it possible to alter basic parameters with unified designs. For large information systems, NMD should be borrowed from YeS EVM if necessary (categories 3, 5, 9).

New devices should be interfaced by controllers and driver subroutines developed for operating systems of computing complexes.

References

1. Theis, D.J., Datamation 1978, Jan. pp 113-131.

2. GML - Coputer Review Peripherals, 1978 No 2.

3. Porter, J.N. IEEE Trans. on Magn. 1978 July Vol MAG-14, No 4.

[402-8617]
CSO: 1863

UDC 681.325.3:62-503.52

ANALOG-DIGITAL COMPLEX FOR PLANNING DISCRETE SYSTEMS OF PROGRAM CONTROL

Moscow PRIBORY I SISTEMY UPRAVLENIYA in Russian No 6, 1980 pp 21-23

[Excerpts from article by V. N. Grishin, K. K. Yeshchin, V. I. Zarovskiy, A. I. Koterov and G. I. Shevchenko]

[Excerpts] Analysis of several specific problems of simulation of discrete systems of program control with digitization by level (DSKU) showed that productivity of digital computers of an analog-digital complex (ATsK) must meet high requirements (e.g., speed up to 1,000,000 or more operations per seoncd). This is because of the complexity of simulation of the process of operation of real systems elements in real time as well as the high precision of reproducing program and controlled functions.

Because investigation of DSKU in ATsK requires considerable expenditures of computer time, the use of expensive high productivity all-purpose digital computers in such ATsK is not economically justified. Research proves that problems of simulation of DSKU can be solved with the necessary precision on ATsK with a relatively simple TsVM of much lower productivity if the structure of the digital computer is specialized, i.e., is designed on the basis of the aspects of operation of DSKU. Furthermore, time expended for simulation of DSKU on ATsK with all-purpose digital computers is several times greater than on ATsK with specialized digital computers (STsVM) because of the considerable expenditure of time to create matching devices and simulation programs.

This article is devoted to a description of a specialized ATsK for investigating and planning DSKU.

Standard AVM of the types "Elektron", MN-18, AVK-2 and others may be used as the analog portion of the complex. The digital part contains PPM and VUM.

Both computers have a common control microprogrammer with 64 128-bit microinstructions.

The characteristics of the complex are cited below.

Program-converting computer

Number of AU bits	20
AU speed, operations/second	10^5
Minimum read time of one punched-card line of PPZU, ms	20
Capacity, in bits:	
PPZU	5×10^5
BZU	6×10^2
OZU	10^2

Control computer

Number of AU bits	20
AU speed, operations/second	10^5
Total capacity, bits:	
BZKCh and OZU_{t_n}	5×10^2
PZU	3×10^3
Access time, microseconds:	
to register OZU	16
to PZU	8

The ATsK may be used in planning control DSKU for industrial processes, metal cutting mills, aircraft, for program control in metallurgy and energy.

The coupling system is composed of PAK and PKA having eight numerial and one symbol digit with conversion time of 0.5 milliseconds; the conversion code is a time interval with discreteness of conversion of 0.5 ms and code to number of pulses with maximum repetition rate of 2 kHz.

[402-8617]

CSO: 1863

UDC 681.3:681.142.621.001.2

ANALOG-DIGITAL CONVERTER WITH GALVANIC SEPARATION OF MEASURING CIRCUITS

Moscow PRIBORY I SISTEMY UPRAVLENIYA in Russian No 6, 1980 pp 23-24

[Excerpts from article by Yu. P. Strashun and B. B. Kishko]

[Excerpts] In elaboration of ASU TP, problems of reducing analog signal input error, increasing accuracy of calculation of technical and economic parameters (TEP) and providing the opportunity for operation of ASU TP with a high level of general interference are crucial. The accuracy of calculation of TEP is increased in the measurement of a mass of initial parameters (standard number 100) for a small time interval (about 0.01 to 0.1 second).

To solve these problems, multiple range high speed analog-digital converters ATsP are required that have several programmable ranges of measurement from ± 10 mV to ± 5 V, conversion time of 100 to 200 microseconds and basic conversion error, depending on the ranges of converted signals, from ± 0.1 to ± 0.5 percent.

One of the efficient structures of multiple range ATsP (MATsP) which enables implementation of multiple channel ASU TP with a minimum of hardware expenditures is a structure which has means of noise suppression for all measurement channels o fthe system, represented by a group circuit of galvanic separation (SGR) of the measurement circuits.

Technical specifications of the elaborated MATsP

Range of converted quantities:	
low level, mV	±10, ±20, ±35 ±50, ±100
high level, V	±1, ±5
Nonlinearity of conversion response, % maximum	0.15
Initial bias voltage drift in 10 mV range:	
time, for 6 hrs, mcV, max.	1-2
temperature, mcV/10°CX, max.	7.5
Coefficient of general noise suppression, dB, at least:	
D.C.	140
A.C. (50 Hz)	120
Permissible noise level, V, max.	100
ATsP digits including symbol	13

Total analog-digital conversion time, μs	150
Input impedance, Megohms, at least:	10

The MATsP is built out of five standard circuit boards of SM EVM 240 x 280 millimeters.

The MATsP will be used in the analog signal input device of control computer complexes SM-3 and CM-4.

[402-8617]

THE YES 1015 ELECTRONIC COMPUTER

ELEKTRONNAYA VYCHISLITEL'NAYA MASHINA YES 1015 in Russian no further data

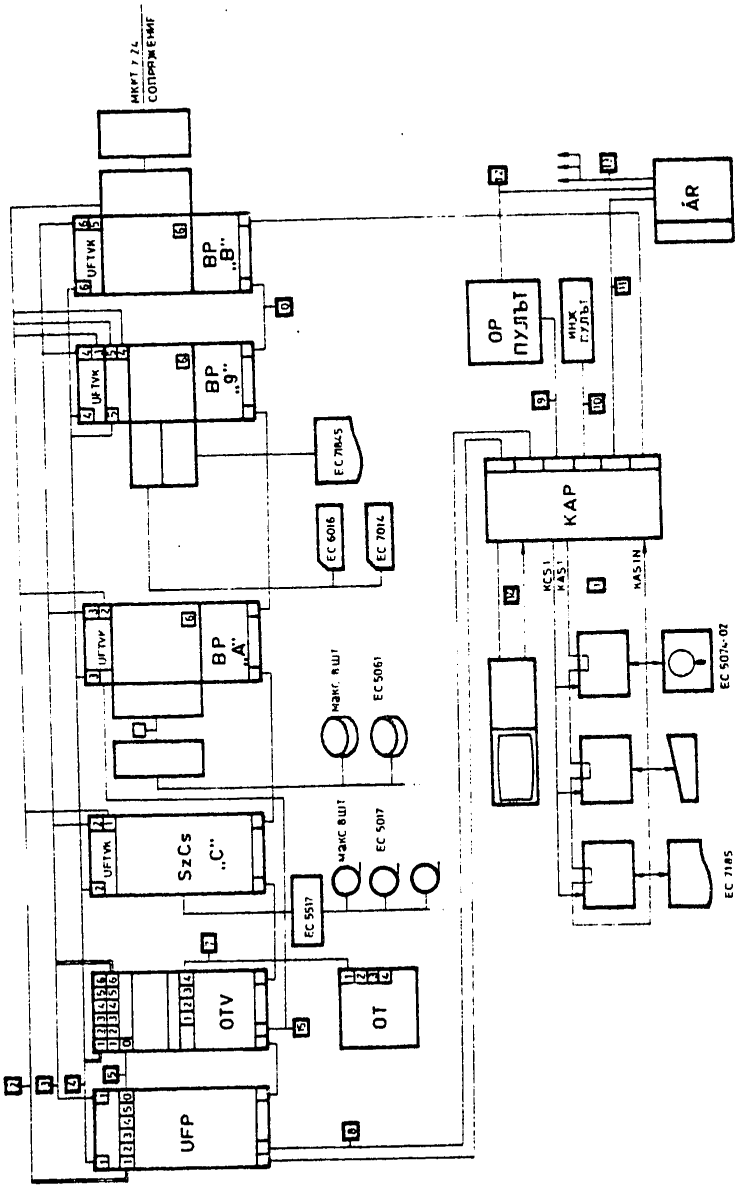
/Equipment Brochures From Recent Exhibitions -- computer developed by the Institute for the Coordination of Computer Technology/

/Text/ General Description

The YeS 1015 computer is the smallest one in the Series 2 YeS EVM /Unified System of Electronic Computers/ family of computers.

Together with the other Series 2 models, it is a result of further development of the YeS EVM.

Characteristics:
in accordance with the principle of decentralized processing, the central processor's functions are based on the parallel-organized operation of several independent processors;
communication: through a console with a display, with the help of easily understood standard messages;
compatibility with Series 1 and Series 2 models;
YeS /Unified System/ DOS /disk operating system/ with maintenance of the virtual memory;
productivity: 19,000-21,000 operations/s for a GIBSON 1 composition, 30,000-31,000 operations/s for a GPO-WU II composition;
highly accurate operations with a floating decimal;
virtual memory of 16 Mbyte;
memory protection;
an error-reporting system that provides increased certainty of error detection, monitor functions with registration of the programmed events that are the basis of the auxiliary equipment for program debugging;
registration of programmed events;
basic memory: maximum of 256 Kbyte;
set of commands: with floating decimal, binary and decimal arithmetic;
high-capacity disks with direct connection;
microdiagnostics.



Basic configuration:
Central processor (includes the basic memory, a display console, data transmission adapter, selector and multiplexor channels, built-in printer adapter): YeS-2115 (1).
Magnetic disk (replaceable) storage units: YeS-5061 (3).
Magnetic tape storage unit: YeS-5017 (3).
Magnetic disk storage unit control block: YeS-5517 (1).
Printer: YeS-7184 (1).
Unit for input from punchcards: YeS-6016 (1).

Purpose

This computer configuration makes it possible to create local and remote systems and to operate in the package processing and dialog modes.

Types of systems for utilization of the YeS 1015:
traditional data processing systems;
systems for scientific and technical planning;
information systems for enterprises;
on-line systems for data base control;
general-purpose education systems.

Basic areas of utilization:
controlling railway transport;
power engineering, primarily for electricity production and distribution, in the gas and oil industry, and the production and distribution of other energy carriers;
scientific and technical calculations;
controlling an enterprise, information systems for controlling resources;
trade, banking and financial operations;
state control;
different data bank systems;
education.

Specifications

1. The central processor consists of three subprocessors of different types.

1.1. Command processing subprocessor (UFP)
Purpose:
calling programmed commands from the main memory;
analysis of function code;
execution of arithmetic and logic commands;
analysis of input-output commands, initiation of appropriate input-output processor.

Time cycle: 550 ns.
The memory itself contains:
check registers;
operation register with floating decimal;

16 general registers;
working registers.

1.2. Input-output subprocessor (IOP), maximum of four with the following functional distribution: one directly controls the attached high-speed printer and the multiplexor channel, the second directly controls the attached disks, the third control the selector channel, the fourth controls the remote data processing communications.
Time cycle: 550 ns.

1.3. Service subprocessor (KAR)
Purpose:
constant monitoring of all functions;
error registration and analysis;
microprogram input;
communication with operator.
The operation of this subprocessor does not depend on the operation of the other subprocessors.
Time cycle: 550 ns.

1.4. Main memory
Structure: integrated circuits produced by MOP /possibly metallic oxide semiconductor/ technology.
Amount of simultaneously transmitted data: 2 bytes (22 bits).
Time cycle: 1 μs.
Access to the main memory is regulated by its control unit (OTV).

Purpose:
collects inquiries for subprocessor service and processes them according to the permanent priority sequence;
reports the nature of subprocessor errors (for example, an error in memory protection, an equipment or addressing error and so on), corrects single errors, reports double errors.

2. Microprogram disk (flexible)
Capacity: 340 Kbyte.
Contains:
the individual subprocessors' microprograms'
error registration area;
programs for the established-error analyzer;
information for the operator.

3. Operator's console: the means for communicating with the YeS-2115 central processor.
Component parts:
YeS-7168 display
operating principle -- TV raster /possibly television screen/
symbol depiction -- 7 x 9 point matrix
number of lines -- 16
number of symbols per line -- 56;

keyboard
  alternative sets of symbols -- 90 with Latin alphabet, 123 with Russian alphabet
  additional panel -- emergency disconnect, network disconnect, functional keys, error signaling lights;
printing console -- YeS-7186;
printing rate -- 180 symbols/s;
number of symbols (Latin, Russian) -- 96;
number of symbols per line -- 132;
operating principle -- point matrix;
size of matrix -- 5 x 7.

4. YeS-5061 magnetic disk storage unit
replaceable package of disks;
capacity of package of disks -- 29.176 Mbyte;
number of operating surfaces -- 20
disk rotation speed -- 2,400 r/min;
number of magnetic heads -- 20;
number of tracks per surface -- 203;
average time of access to information -- 65 ms.

5. YeS-5017-A magnetic tape storage unit
type of information registration -- NRZI;
recording density -- 32 bits/mm;
tape length -- maximum of 720 m;
tape movement speed -- 2 m/s;
capability for reading in two directions.

6. YeS-7184 printer
number of symbols (Latin, Russian) -- 96;
number of symbols per line -- 132;
printing speed -- maximum of 1,100 lines/min;
operating principle -- drum-type unit with impact operation.

7. YeS-6016 unit for input from punchcards
reading speed -- 1,000 cards/min;
operating principle -- photoelectric;
type of cards used -- 80 or 90 columns;
card code: KRK-12;
output code: DK01.

8. YeS-7014 unit for output on punched tape
punching speed -- 140 cards/min;
punching principle -- mechanical;
hopper capacity -- 1,500 cards;
capacity of two storage units -- 1,400 cards each;
type of punchcard -- 80 columns;
card code -- KRK 12;
output code -- DKO 1.

Software

The operating system for the YeS-1015 is a further development of the Series 1 operating system and fully utilizes the advantages of the Series 2 functions.

Basic characteristics:
virtual memory servicing;
multiprogramming;
5 sections (in each section there is a virtual memory of 16 Mbyte and 99 initiatable subtasks);
POWER (automatic operation of slow peripheral gear);
selection and execution of tasks according to a changeable priority rating;
parameterized, cataloged procedures;
support of operator console's SMO /queueing system/;
program translators with high-level languages: PL/1, COBOL, FORTRAN;
support of remote data processing equipment's SMO (VTAM).

The YeS-1015's operating system (DOS 3) was developed through the combined efforts of workers from the Czechoslovak Socialist Republic, the Hungarian People's Republic and the USSR.

The YeS-1015's KPTO /complex of programs for technical service/ provides it with efficient maintenance and preventive maintenance.

The KPTO for Series 1 computers was basically realized on programs, but for the YeS-1015 computer this role is filled by a microdiagnostics system that is a standard part of the computer.

Basic functions of the KPTO:
elimination of correctable errors arising during operation;
registration of malfunctions in the automatic mode;
automatic testing of the computer during preventive maintenance;
discovery of defective units and assemblies.

/8144/1297-11746/

11746
CSO: 8144/1297

THE SM-52 ELECTRONIC COMPUTER

ELEKTRONNAYA VYCHISLITEL'NAYA MASHINA SM-52 in Russian no further data

/Equipment Brochures From Recent Exhibitions -- computer produced by Videoton Computer Equipment Plant/

/Text/ General Description

The central processor contains ECL microprocessors. The coupling units and monitoring devices are built on the basis of large-scale integrated circuit technology.

Physically, the SM-52 computer has three functional lines:
the OZU /main memory/ bus;
the peripheral gear bus;
the operating unit bus.

The main memory is based on high-capacity MOS memory modules. Memory access time is reduced by the use of a "CACHE memory," which prepares for reading from the memory -- the OZU areas used are entered beforehand in the "CACHE" memory. Thus, the central processor is 90-95 percent prepared to obtain the necessary data from the "CACHE" memory.

Separate operator modules and operating units accelerate the processing of data. (An operator with a floating decimal and so forth.)

On the basis of optimization of the problems related to the computer's software and hardware and decentralization of the logic functions, a large increase in the computer's capacity is insured.

The SM-52 has a well developed microprogramming system. The central processor's SOZU /high-speed memory/ is loaded from the OZU. Microprograms from peripheral controllers realize physical control of the peripheral gear independently. Each time the computer is turned on, the central processor's microdiagnostics system checks the central processor, the OZU and the "CACHE memory."

There are two basic types of peripheral gear control units:
coupling units that carry out autonomous translation and controllers with microprocessor control;
coupling units with programmed translation control.

The independent servicing of the peripheral gear lightens the load on the central processor considerably.

The system has a large-capacity external storage capability:
fixed disks;
disks with replaceable 5-50 Mbyte packages;
magnetic tape.

Because of special equipment features, the SM-52's operating system's modular construction makes it possible to have a monofunctional/multitask or multifunctional/multitask organization of the operating mode, which provides the appropriate shielding between separate functions and tasks.

Purpose

The Model SM-52 is used primarily at the highest level of a hierarchical control and automation system. It insures simultaneous execution of different kinds of problems that relate to the following areas of application:
integrated control of small enterprises;
information reprocessing systems for administrative work;
checking and controlling technological processes;
technological preparation for production;
monitoring of finished products and experimental and technical-diagnostic systems;
automated systems for scientific testing.

The architecture and design of the SM-52 computer insures the realization of operational work.

Basic Specifications

OZU:
capacity -- 1 Mbyte;
cycle time -- 980 ns.

"CACHE" memory:
capacity -- 8 K words;
cycle time -- 250 ns;
efficiency -- 90-95 percent.

Data format:
word -- 16 bits;
binary word -- 32 bits;
byte chain -- n x 8 bits;
data with floating decimal -- 32 bits;
data with floating decimal and double accuracy -- 48 bits.

/8144/1297-11746/

11746
CSO: 8144/1297

THE YES 1010 M ELECTRONIC COMPUTER

ELEKTRONNAYA VYCHISLITEL'NAYA MASHINA YES 1010 M in Russian no further data

/Equipment Brochures From Recent Exhibitions -- computer produced by Videoton Computer Equipment Plant/

/Text/ General Description

The modernized R-10 also differs from the earlier R-10 in its external appearance. The control console has disappeared and the computer is started with the help of a built-in microprogram, by turning a starting key. Because of this, maximum simplification of the computer control process has been achieved.

The central processor is laid out on a single-printed-circuit board. Realization on a single board increases the computer's reliability significantly. The fitness for operation of the central processor and the internal storage are monitored by microdiagnostics. Built-in microprocessors in the peripheral gear coupling units provide autonomous input-output control simultaneously with operation of the central processor. The modernized R-10 makes it possible to load programs and data from another computer that is some distance away and also makes it possible to perform remote diagnostics. Its significant advantage is its internal storage, which has been expanded to 128 Kbyte (64-Kbyte program area and 64-Kbyte data area). The user software that was developed for the R-10 can also be used with the modernized R-10.

Depending on the user's needs, there are four basic configurations of the modernized R-10.

Model 10

A small computer with a single operator's position, for scientific and technical calculations, for use in industry and laboratories.

Because the Model 10 is a table-top computer, it can be used under the normal conditions encountered in an office, an auditorium, or a laboratory.

The system's basic configuration is:
a central processor with a 32-Kbyte memory (that can be expanded to 64 K);
a console display with two built-in minicassette magnetic tape storage units.

Optionally, it is possible to connect to the system a flexible magnetic tape storage unit and industrial USO (communication-with-object devices) input-outputs.

The Model 10's software system contains a macroassembler, a FORTRAN IV program translator and an RTM real-time monitor.

A data control subsystem on a flexible magnetic disk and a real-time input-output system are used to control the optional units.

The Model 10 can be used for program writing, with the help of interactive text-editing and utility programs.

The Model 10's software is compatible with the other, larger models of the modernized R-10.

Model 20

The Model 20 is a system for processing data on a real time scale that is oriented for several user/operator positions.

The most important components of the system are intelligent, display-type operator positions, large-capacity disk storage, and special software for processing transactions.

The Model 20 was developed for use in an office.

Composition:
central processor and 128-Kbyte ferrite or semiconducting memory;
console-type operator's display;
replaceable cassette disk;
high-speed matrix printer;
display-type operator positions (maximum of four);
punchcard reader;
magnetic tape;
DMS-60 data base and transaction control processing system.

Model 30

The Model 30 can be used as a concentrator for large computers or as a system for entering data from many operator's positions.

The display terminals are connected to the central processor through two- or four-wire data transmission lines in such a manner that they can be at some distance from the central processor.

Composition:
central processor with 64- or 128-Kbyte memory;
operator's console with two built-in minicassette magnetic tape storage units;
synchronous data transmission control unit (combined with a console display control unit);
a maximum of 32 display terminals;
high-speed matrix printer;
replaceable disk;
magnetic tape.

The Model 30's standard software contains an RTDM real-time disk monitor. Optionally, a DTM data transmission subsystem can be order for it.

Programs can be written from the console display, in the interactive mode, with program and test writing being facilitated by auxiliary programs.

Model 40

The Model 40 is a general-purpose computer system that is intended primarily for the realization of data processing tasks. Because of its large-capacity disk storage units and efficient software, it can also be used in situations where previously it was necessary to install a computer from a higher cost category. This system can be used very efficiently for package processing, while its architecture and software system make it possible to construct multiterminal configurations also. The Model 40 system, which is set up in 19-inch frames, is suitable for simultaneous package and terminal-oriented processing.

It has a 128-Kbyte memory (64-Kbyte program area and 64-Kbyte data area) and disk storage with direct access, all of which make it possible to perform simultaneous services for several users in a manner comparable to large data processing systems, and with the help of the "on-line" terminal mode it can do this with multiple access.

Composition:
central processor and 128-Kbyte magnetic or semiconducting memory;
operator's console with two built-in minicassette magnetic tape storage units;
replaceable magnetic disk cassette storage unit (maximum of four);
magnetic tape storage unit (maximum of four);
punchcard reader;
high-speed printer.

Options:
display terminals (maximum of 32);
replaceable large-capacity disk.

The Model 40's software system has the following programming languages at its disposal:

ANSI COBOL;
FORTRAN IV;
Macroassembler,
all of which can be used to write package processing programs.

Purpose -- the modernized R-10 is particularly suitable for:
use in laboratories and offices;
controlling a data base and processing transactions;
performing remote processing;
connection to large computers as an intelligent terminal.

Specifications of the Central Processor

A 16-bit, microprogrammed central processor laid out on a single printed-circuit board.

Number of interrupt levels: 32/64, by selection.
Number of registers: 16.
Input/output: the central processor, the peripheral gear coupling units and and memories are connected to a single line.
Line transmission rate: 2.3 Mbyte/s.
The coupling units for complicated peripheral gear (storage units, data transmission lines and so on) are controlled by microprocessors.
Number of peripheral great coupling unit boards:
table-top version: 7;
frame version: 14.

Maximum memory: 128 Kbyte (64-Kbyte program area, 64-Kbyte data area), ferrite or semiconducting (0.8 and 0.45 s, respectively).

Compatibility:
set of commands: contains set of R-10 commands + bit control commands;
programs: can execute all user programs written for the R-10.

Software:
The high-level programming language PROCOL, which was specially developed for this purpose, is used for the multiproblem real-time mode.

With the help of PROCOL, on the modernized R-10 it is possible to program in a high-level language those problems that until now could only be programmed on the assembler level in most computers.

As an option, this programming language can be ordered together with the RPG II.

The centralized program-writing and data-control system makes it possible to run programs written in different languages simultaneously and, moreover, to use several programming languages in a single program.

Depending on the area of utilization and the mode, the optimum system for controlling programs can be selected from among several operating systems:
DBM -- with package processing;
RTDM -- for package and "on-line" processing;
MTM -- for the multiproblem mode.

Monitors are used on a disk storage unit with a unified structure, which makes it possible to replace the monitors while preserving the data files.

11746
CSO: 8144/1297

THE YES 1011 ELECTRONIC COMPUTER

ELEKTRONNAYA VYCHISLITEL'NAYA MASHINA YES 1011 in Russian no further data

/Equipment Brochures From Recent Exhibitions -- computer produced by Videoton Computer Equipment Plant/

/Text/ General Description

In order to take care of different kinds of users' needs, Videoton offers the R-11 system, which is based on central processors with different capacities.

The Models R-11/10, 20 and 30 are modern means for the decentralized processing of data that can also be used in large computer networks as their medium-capacity members.

The Models R-100 and 200 are large-capacity systems with the capability of memory enlargement to 1 Mbyte with a multifunctional organization, on the basis of which several independent problems can be solved simultaneously.

The central processor in all the models is a 16-bit microprogrammed processor that is realized on one (for the R-11/10, 20, 30) or two (for the R-11/100, 200) TEZ's.

The architecture of the models is characterized by the following features:
the memory has a segmental system;
multifunctional organization;
common, newly written subroutines;
separate subprograms (tasks) have their own memory fields (stacks).

Purpose and Operating Modes

Technical calculations and data processing:
traditional computer center problems;
scientific research;
data processing operations in enterprises.

Remote data processing:
computer networks: R-11--V-11;
emulation of the "Remote job terminal" type: access to Siemens, IBM and YeSK computers and computers that are interchangeable with them;
access to the Kh25 postal network;
circulation of inverse transaction data base.

Use in a time-sharing system:
multiconsole educational system;
interactive program development.

Industrial uses:
control of industrial processes;
hierarchical networks based on R-11 models of different capacities and on elements of a Vt-70000 programmable, remote subscriber's point.

In the multifunctional mode, the Models R-11/100 and 200 can provide the applications mentioned above simultaneously, in the form of subfunctions.

Hardware

Magnetic disks: 5 and 62 Mbyte.
Display terminal: 75-9,600 bits/s.
Punchcard reader: 600 cards/s.
Flexible disk storage: 255/380 Kbyte.
NML /magnetic tape storage/: 800 and 1,600 bits/s.
ATsPU /alphanumeric printer/: 300, 600, 900, or 1,200 lines/min.
Matrix ATsPU: 180 symbols/min.

Software

Depending on the type of central processor, the R-11's basic software consists of two levels.

Level 1 (Models 10, 20, 30). The R-11's software system is based on components that have been repeatedly, regularly and successfully used in the R-10, to which have been added new and efficient services both in the area of operating systems and in the areas of programming languages and system users.

The DMS-60 is a general-purpose piece of software for use with data bases that functions as a subsystem under the control of a "Multitask Monitor," which itself is capable of solving problems in a significant part of its applications. The data files form a centralized data base. The system for processing transactions when requested from the individual operator positions is built up on this data base. Users have access to the data base memory and can interrogate them by the interactive method, modify them and also process data. The DMS-60 has all the software facilities needed to construct the data base, for the modification of its architecture, and for conversion to the specific needs of individual users.

The ANSI-standard COBOL language makes it possible to handle sequential, indexed-sequential and relatively organized files, resolve segmented program organization, and carry out effective program testing during program conversion and running.

The programming language is analogous to the internationally distributed language RPG II, and is a simple and efficient means for data processing programming.

The extraordinarily efficient language FORTRAN IV, which contains significant additions relative to the standard, is available for making scientific and technical calculations.

The modern, highly developed programming language PROCOL, with combines the simplicity of FORTRAN with high-level programmability of the functions needed for operation on a real time scale, is used for the preparation of programs operating in the "multitask" mode.

The language capabilities listed above are supplemented even further by an efficient macroassembler.

The operating system can be generated in accordance with specific requirements.

Level 2 (Models 100, 200). The second-level software is based on a multifunctional "multitask" monitor that uses special architectural properties. The MTM-2 can control several user functions. Each of them has its own operating area and makes use of the same central monitoring services.

Programming is facilitated by different programming languages that have been developed:
MAS macroassembler;
FORTRAN;
LTR;
COBOL;
BASIC;
MAG macrogenerator.

User libraries and program packages:
library of mathematical programs with single and double accuracy and fixed and floating decimal;
library of operations in the decimal system;
library of scientific and statistical FORTRAN subroutines.

Basic Specifications

Models R-11/10, 20, 30:
32 (or 64) interrupt levels;
123 machine commands;
16 registers;

central processor, memory and peripheral gear interfaces are connected to a general-purpose "MONOBUS" line (transmission rate: 2.3 Mbyte/s);
peripheral gear interfaces are based on microprocessors;
remote loading and remote diagnostics capabilities.

Models R-11/100, 200:
32 (or 64) interrupt levels;
155 machine commands;
16 registers;
central processor, memory and peripheral gear interfaces connected to the same "MONOBUS" (rate: 2.3 Mbyte/s);
peripheral gear interfaces are based on microprocessors;
possibility of enlarging memory up to 1 Mbyte;
automatic microdiagnostics;
remote loading and remote diagnostics capabilities.

/8144/1297-11746/

11746
CSO: 8144/1297

UDC 62-52(75)

PRINCIPLES OF THE CREATION OF LARGE AUTOMATED CONTROL SYSTEMS

Moscow OSNOVY SOZDANIYA BOL'SHIKH ASU in Russian 1979 pp 126-141, 179-182

[Sections from the book "Osnovy sozdaniya bol'shikh ASU" by Valentin Aleksandrovich Baranyuk, Yevgeniy Semenovich Bichugov, Aleksandr Ivanovich Cherkashchenko and Shamil' Umyarovich Urazgel'diyev, edited by V. A. Baranyuka, Izdatel'stvo Sovetskoye Radio, signed to press 27 November 1978, 10,600 copies, 360 pages]

[Additional selections from this source appeared in a previous issue of this report - see JPRS L/9204, 23 July 1980, pages 141-147]

[Text] 4.3. Means of Man-ASU Contact

Until recently man interacted with electronic computer equipment mainly by means of perforator input-output and printing equipment. However, the need to assure close man-machine dialogue in the process of work required the use of more flexible terminals which permit asking the machine questions and giving it tasks directly from the working place of the operator without complex preliminary work on the preparation and formalization of starting data. It was desirable to obtain at the same working place the responses of the machine and the results of the solution in sufficiently graphic form.

By the end of the 1960's those functions, as a rule, were entrusted to ordinary teletypes, at times modified somewhat, connected to a computer provided with suitable programs for processing arriving communications, and also programs for the formation of codograms containing the results of solution. Special terminals modified for the assembly, automatic coding and input into the computer of the necessary data, and also for the output of information from the computer, began to appear later. Such equipment must contain a panel for the assembly of data and also means for visual monitoring of the assembly and for the issuance of information arriving from computers (Fig 4.3). Those functions usually are performed by an indicator on a cathode-ray tube, a special electrical printer, or some other means. Perforator input-output devices are sometimes additionally included in the equipment.

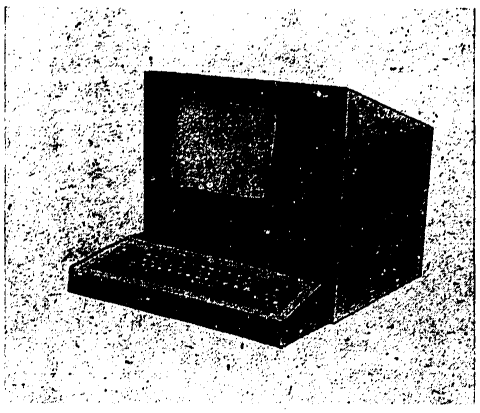


Figure 4.3
YeS-7061
display panel.

The wide distribution of such terminals is explained by the need to provide convenience for the work of man with the computer, on the one hand, and by the rapid development of systems with time separation, capable of simultaneously servicing a large number of users. If the user is at a considerable distance from the computer, the terminals include means of connecting them with communication channels.

Such very complex terminals not only assure data input-output but also partially process information. Actually, such equipment contains a small computer which transforms the formats of data, provides buffer storage of information, organizes exchange of data with the main computer and performs a number of other specific functions, relieving the central processor of them and improving the utilization of costly communication channels. An auxiliary processing unit often assures the functioning of several terminals.

Widely used at the present time are terminals which permit introducing into a computer from a panel not only alphanumeric but also graphic information. Visual monitoring of input by means of a cathode-ray beam is assured in that case (Figure 4.4). On the same cathode-ray beam the results of solution of problems with the necessary textual and digital explanations are issued from the computer in graphic form. The panel permits readily introducing partial changes in the graphs depicted on the cathode-ray tubes. To do that, the operator working at the panel shifts the marker from the necessary point and gives the computer instructions for corresponding change of data input earlier or obtained as a result of solution. Used for the same purpose is a light pencil, by pointing which at a given place on the cathode-ray screen it is possible to set the

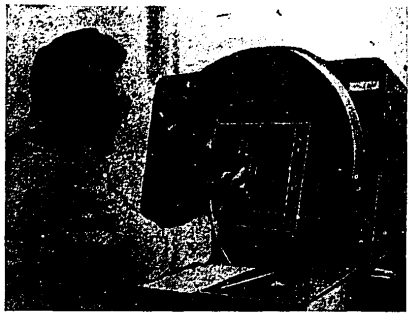


Figure 4.4. The YeS-7065 graphic display.

coordinates of the necessary point. With a marker or a light pencil lines, point and signs are drawn or erased on the screen. The position of new signs fed to a computer from a panel can be shown.

Within the framework of the Unified Electronic Computers System the socialist countries have developed a whole series of terminals for various purposes and of various complexity, in particular, several types of equipment for remote input and output of alphanumeric and graphic information.

User stations have been developed by the People's Republic of Bulgaria (YeS-8501), the Hungarian People's Republic (YeS-8503 and YeS-8570) and the GDR (YeS-8505). Units and devices produced by the industry of other socialist countries have been used.

The YeS-8501 user station is intended for the local input of data into a computer either from a printer keyboard or from punched carriers. It includes a "Konsul" electric printer (YeS-7172 or YeS-7174), a device for input from punched tape or cards with edge perforation YeS-6191), a device output on punched tape or cards with edge perforation (YeS-7191 or YeS-7192), a device for input from punched cards (YeS-6111), and a device for output on punched cards.

The YeS-8503 user station (Figure 4.5), in contrast with the YeS-8501 station, does not have punched-card devices for information input and output, but instead can be removed from the computer and work through a communication channel with a speed of 600 or 1200 bauds.

Remote information input-output is also provided by the YeS-8570 user station, which consists of a "Konsul" printer (YeS-7172 or YeS-7174) coupled with a communication channel. A transmission speed of 200 bauds is allowed.

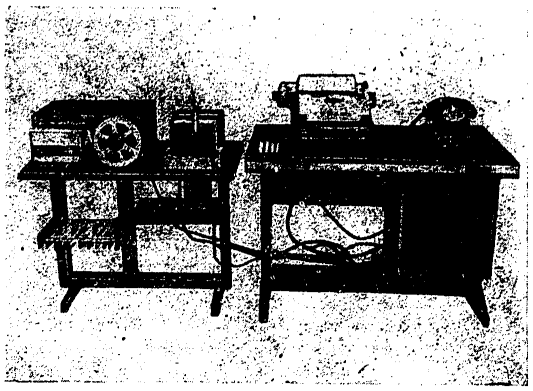


Figure 4.5. The YeS-8503 user station.

The YeS-8505 user station can assure simultaneous work of up to 16 peripheral terminals, connected by a single control unit (with a distance of up to 1000 m from the control unit). The following can be used as peripheral devices: an electrical printer, a device for output to punched tape and magnetic tape, a device for interrogating sensors of measured values, and signal converters (modems) (YeS-8002, YeS-8005, YeS-8006 and YeS-8028). The information transmission rate can be from 200 to 1200 bauds, depending on the selected modem model.

A device intended for information exchange between an operator and a computer processor through a standard input-output channel (standard interface) is a relatively simple terminal. The device consists of an electric printer and a unit for coupling with a standard channel. Using the printer keyboard, an operator can introduce data into the computer and simultaneously print the data on paper. The output is printed on sheets of paper (or paper tape). Several models of such equipment have been developed (YeS-7070, YeS-7071, YeS-7073 and YeS-7074). Their main technical characteristics are presented in Table 4.3. Figure 4.6 presents the external appearance of one of those devices.

As has already been pointed out, the display is the most convenient terminal for man, but it is costly. Six models of displays have been developed in accordance with the program for the creation of the Unified Electronic Computer System, two models in the USSR (one for work with alphanumeric and graphic information, the YeS-7064, and the other for work only with alphanumeric data, the YeS-7066).

Table 4.3 Printer with unit for coupling with a standard channel

Model	Developer country	Number of printable characters	Printing rate, characters per second	Characters per line	Number of copies	Power V/Hz	Dimensions, mm	Power consumption, W
YeS-7070	USSR	93	10	106	5	220/50	1000 x 620 x 300	200
YeS-7071	CSSR	92	10	106	5	220/50	Table 640 x 590 x 690 Cabinet 1200 x 600 x 700	200
YeS-7073	GDR	90	10	117	5	220/50	2070 x 690 x 900	250
YeS-7074	Bulgari	93	10	123	8	220/50	1200 x 700 x 1100	500

Figure 4.6. The YeS-7071 electrical printer.

APPROVED FOR RELEASE: 2007/02/08: CIA-RDP82-00850R000300050028-3

The YeS-7064 is intended to provide complex planning and design and other calculations with the output of graphic images on the screen of a cathode-ray tube. The possibility of correcting images on the cathode-ray tube has been envisaged. The device includes the following functional units: a control device, a main memory unit, a block for coupling with a channel, sign and vector generator units, a cathode-ray tube indicator unit, an alphanumeric and functional keyboard with control, power units with control, a light pencil with control and an engineer's control panel.

The device has programmed control. The program and data for registration are stored in the local main memory. By using the processor program and the light pencil it is possible to perform various operations with the image: erasure, displacement, selection, reversal, scaling, input from a keyboard of text at any place on the screen and other operations.

Another type of display, developed in the Soviet Union, the YeS-7066 display panel, is intended for alphanumeric information input-output. By means of a keyboard an operator can record, erase, request needed data from the computer, correct and forward data to the computer or issue the data to a printer.

In input conditions the operator enters on the panel keyboard the necessary data, which are recorded in the buffer storage of that panel and shown on the screen. After making the entry the operator sends an inquiry signal to the computer, on which the machine refers to the buffer storage and reads off the data recorded in it. The data entered on the display when the corresponding functional key is pressed can be recorded again in the buffer storage of the printer and printed.

In conditions of data output from the computer, at the operator's request the data are first recorded in the buffer storage, and then are issued to the screen or the printer.

The YeS-7066 display is connected to a standard YeS computer channel, not directly, but through a special YeS-7566 control unit. Figure 4.7 shows the connection diagram. The YeS-7066 display can be removed from the control unit to a distance of 500 m. The unit can provde control of several YeS-7066 displays. It contains a buffer storage common to all and a unit for coupling with the YeS computer channel. A printer (the "Konsul" printer) is connected to the latter. The total number of displays connected to the YeS-7566 control unit depends on the used display format but cannot be larger than 16. The YeS-7066 indicators are connected to the YeS-7566 control unit by a maximum of four branches, the number of them in each branch is arbitrary, but the total number must not exceed the quantity dorresponding to the set format. Four formats can be used to depict information on a screen (Table 4.4).

Figure 4.8 shows the general appearance of the YeS-7066 display and the YeS-7566 unit.

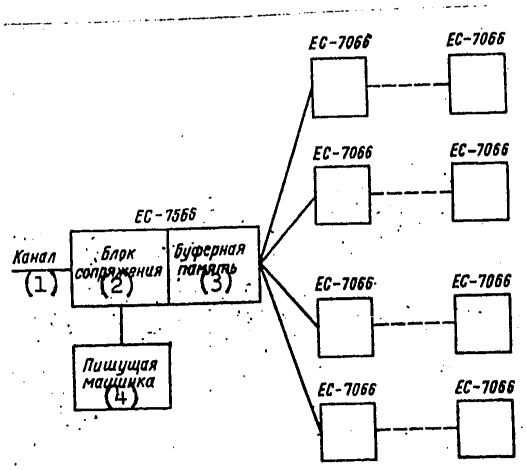


Figure 4.7. Block diagram of connection of external panels to group control unit. EC = YeS
1 -- Channel
2 -- Coupling unit
3 -- Buffer storage
4 -- Printer

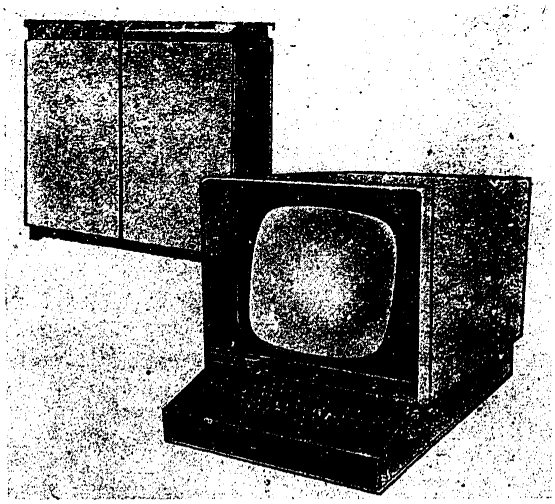


Figure 4.8. General appearance of the YeS-7066 display and the YeS-7566 control unit.

Besides the Soviet Union, the Hungarian People's Republic has participated in the development of displays for the Unified Electronic Computer System; four display models (YeS-7061, YeS-7063, YeS-7065, YeS-7068) have been developed there. The principal technical characteristics of displays developed according to the YeS EVM program are presented in Table 4.5.

The terminals of the models under consideration are fairly universal. With them any alphanumeric or even graphic information can be fed to or taken from a computer.

A negative aspect of that universality is the relatively large time needed for information entry. In an ASU a limited number of types of strictly formalized data is fed into a computer fairly often from a workplace. For example, in the system for control of production, from the worplace at a machine tool it is possible to introduce: the quantity of manufactured articles and remaining (or required) billets, data on machine tool breakage (with indication of the type of defect) and other formalized information. It is clear that for the input of such standard information there is no sense in installing universal equipment even of the type of the teletype, but it is advisable to set up as simple a sensor as possible, one which would permit the input of only information of the required types into the system. In the presented example an instrument with an input mechanism of the telephone dial type, coding dialed information and issuing it to an appropriate communication line, can serve as a sensor.

In more complex systems, specialized display panels, the keyboard of which is adapted for the input of data characteristic of a given system, serve as terminals. Thus, in automated systems for military purposes, intended for the rapid reporting to addressees of battle orders and dispatches, it is advisable to use panels which would permit, by pressing a total of a few buttons, rapidly selecting the address and content of a message. The input and subsequent transformation of information are monitored on a cathode-ray tube, as on an ordinary display. On the same cathode-ray tube information is displayed which arrives from other workplaces or facilities. The information to be displayed on the cathode-ray tube is prepared, as a rule, by the computer of a given facility, but this can be partially done by the processor of the corresponding (fairly complex) workplace.

"Charactron" cathode-ray tubes were used 8-10 years for information display; now they have been completely displaced by the ordinary television cathode-ray tube, the beam of which is controlled by special sign generators. As a rule cathode-ray tubes are used as displays for individual use. The size of the screen and the of the characters displayed on it does not permit more than one or two operators to work with them. Recently, however, cathode-ray tubes have also begun to be used for large-scale images. In some systems this is achieved by projecting the the image taken from the screen of a cathode-ray tube onto a large screen, in others the screens of several tubes are combined into a single screen; in that case the screen of each tube is part of a single information field. It is

Table 4.4. Display formats

Model number	Format code	Lines per frame	Characters per line	Maximum number of indicators connected to control unit
1	00	12	80	4
2	01	6	80	8
3	10	12	40	8
4	11	6	40	16

natural that the devices for control of such display systems are incomparably more complex than the corresponding device of the indicator for individual use. An advantage of displays based on cathode-ray tubes is the possibility of programmed change of the formats of displayed information, and also the assignment of a set of conventional symbols, which is needed for a given specific system.

Display panels composed of a large number of special elements of various sizes which permit lighting any digit from 0 to 9 are also intended for collective use. Electroluminescent indicators, digital incandescent lamps, digital thyratron indicators, etc, are used as them. The size of the element and brightness of the luminescence determine the distance from which work with the display panel is possible, and the number of them--the size of the panel itself. The lines and columns of such a display are designated in advance. This circumstance, and also the fact that on such a display panel it is possible to display only digital information, requires that they usually be used only as auxiliary means of display, supplementing screen information.

Also widely used at facilities with ASU are printing and graphic documentation equipment. Besides electrical printers, which automatically print information issued by computers (the low working rate does not permit their use as the principal means of printing information, and only short messages are usually issued on them), alphanumeric printers are used for the issuance of documents in a volume of several hundred or more characters, and their speed is greater by two orders of magnitude than that of electrical printers. The principal technical characteristics of alphanumeric printers developed by the present time in accordance with the YeS EVM program are presented in Table 4.6. Their high working speed is assured by line printing. In an alphanumeric printer all characters of the next line, previously prepared and recorded in an appropriate place in the storage, are printed simultaneously.

At the present time drum-type alphanumeric printers are mainly used, but there also are other design solutions. To obtain higher speeds, chain-type alphanumeric printers, in which the type is arranged on a closed chain that moves along the line, are being developed. As in the drum-type printer, small hammers behind the paper briefly press it against the corresponding type characters at the necessary time. It should be noted, however,

Table 4.5. Main technical characteristics of displays

Device	Model	Developer country	Screen size, mm	Working field, mm^2	Maximum number of characters on screen	Number of lines	Characters per line	Power, V/Hz	Size, m^3
External panel for cathode-ray tube alphanumeric data input-output	YeS-7061	Hungary	200	150x200	1024	12(16)	80(64)	220 50	420x620x350
Cathode-ray tube device for alphanumeric data input-output	YeS-7063	Hungary	200	150x200	960	24	40	220 50	External panel 720x1035x715 Printer 600x730x715
Device for input-output of alphanumeric and graphic information	YeS-7064	USSR	430	250x250	2100	35(52)	49(74)	380/220 50	Control unit 1208/750/1600 Console 1490/660x700 Indicator 660x600x500
Alphanumeric and graphic displays	YeS-7065	Hungary	600	360x360	2000				
External panel (with YeS-7566 unit)	YeS-7066	USSR	430	320x180	960	6(12)	80(40)	220 50	730x480x470
Alphanumeric display	YeS-7068	Hungary		200x150	1400	16	80	220 50	350x347x700

Table 4.6 Alphanumeric printers

Model	Developer country	Number of printable characters	Printing rate, lines/min	Characters per line	Number of copies	Power, V/Hz	Dimensions, mm x mm x mm	Power consumption, W
YeS-7030	USSR	82	650-890	128	2	380/220 50	1516x683x1425	2000
YeS-7032	USSR	84	900	128	5	380/220 50	1600x650x1270	2000
YeS-7031	GDR	68	900	156	3	380/220 50	2770x670x1261	
YeS-7033	Poland	84	900	120, 128 or 160	5	380/220 50	1250x820x1270	3500
YeS-7034	CSSR	84	600-900	132	5	380/220 50	1370x780x1400	
YeS-7035	GDR	63	500	120	3	380/220 50	2770x670x1261	2000
YeS-7038	CSSR	84	750-1100	160	5	380/220 50	1500x780x1400	
YeS-7039	Hungary	64(96)	245-1100	80(132)	6	220 50	1170x1230x620 (580x610x560)	

that the great speed of the chain-type alphanumeric printers (up to 2500 lines/minute) is achieved through considerable complication of the control unit. Drum-type alphanumeric printers, which have been well organized by industry and are produced in large quantities, still remain the main ASU printing devices. However, together with the merits, most alphanumeric printers have substantial shortcomings, poor reliability and a fairly high noise level.

Figure 4.9. The YeS-7054 plotter.

The striving to get rid of the shortcomings led to the development of impactless printers: electrostatic, thermographic, jet and magnetographic. Impactless printers as a rule are less noisy than impact printers, and are potentially more rapid. Their main merit is high reliability. Almost any impactless printer can provide a mean time to failure an order of magnitude larger than an impact printer. However, impactless printers require special paper and many of them print characters in the form of a matrix of points (not always readily legible) and almost all the devices make only one copy of a document.

Graphic drawing devices (plotters) (Figure 4.9) used to construct graphs, plans, maps, etc, are being widely introduced into practice. The technical characteristics of plotters developed in the YeS EVM system are presented in Table 4.7. Those devices are used for the direct output of graphic information from computers and as a drawing device controlled by symbols read off punched tape.

5.5. Distribution of Functions Between Man and Technical Means of Automation

As already noted, an ASU includes three basic functionally connected classes of hardware for information transmission (channels), information processing (information computer centers), interaction of man with means of information processing and transmission (user stations, printers, visual displays, etc).

This hardware is used in practically all stages of the activity of administrative agencies to solve completely determined problems.

In the process of collection of information about the state of a controlled system the officials of an administrative organ are provided with data on the situation and the state of subordinate facilities. In that case, a complex of hardware is used to automate preparation for the input and output of information in the system, its transmission via communication channels from sources to users, the reception, accumulation, estimation of reliability, systematization, continuity or periodic renewal of information, the retrieval and collection of necessary data, their grouping in accordance with previously determined forms and issuance to the workplaces of officials of the administrative orgaan in the form of alphanumeric text, and also in graphic form on special displays (display boards, screens, light tables, etc).

In the stage of analysis of the situation and the adopting of decisions on questions, information is issued on the situation (the state of the environment in the controlled system), various reports and documents needed for analysis, the solution of various computational problems in estimating the possibilities of controlled facilities and forecasting the development of the situation.

In the process of planning the activity of a controlled system the officials of administrative organs are provided with the results of the solution of problems connected with various stages and alternatives of planning. In that case the following are automated: preparations for the input and output of starting data, the solution of information and computational problems, the documentation and issuance of the results of solutions of problems at workplaces and correction of the current plan.

By means of the system's hardware, various orders, directives, publications and instructions are reported to executives, and the course and results of execution of issued orders are also operatively monitored.

Thus the activity of the controlling organ in an ASU is accomplished in conditions of close interaction of man with system hardware (electronic computers, communication channels, displays, etc). Therefore in an automated system enormous importance is acquired by the problem of rational distribution of functions between man and machine, which arises in the early stage of planning the system and remains urgent in all stages of its

creation. It is connected above all with estimation of the possibilities of man as a component part of the system and the limitations caused by its inclusion in all the processes accomplished in an ASU. On how rationally the interaction of man and equipment has been organized the quality of execution of tasks of control and the specific solutions with respect to the composition of the administrative organ will depend to a considerable degree.

The problem of the distribution of control functions in an ASU is a complex multilevel problem. Its solution is connected with very important questions in the planning and creation of systems:

--the selection of indicators of the quality of functioning of "man-machine" systems;
--substantiation of the rational structure of the administrative organs;
--determination of the composition of the hardware of specific facilities of a control system;
--investigation of the reliability of functioning of the "man-machine" system.

The main content of the activity of personnel in an ASU consists in the decision making procedure. Obviously that function in large-scale organizational systems will always or at least in the foreseeable future remain the exclusive right of man, as is stipulated by the high degree of responsibility of officials for the quality of adopted decisions. In addition, the process of decision making involves a need for a creative approach to the estimation of phenomena of reality, with capability of action in complex conditions involving risk and indeterminancy. However, the possibility of formalizing the creative activity of man and his heuristic capabilities is limited at the present time.

Analysis of the activity of the operative composition of higher units of the administration of various systems shows that the most labor-intensive processes on which the main portion of working time is expended are data collection and processing, the making of operative calculations and document preparation. At the same time, in its content the main part of that work has a historical, technological character, is fairly easily formalized and can be entrusted to the hardware.

On the other hand, the unprecedented complication of organizational and functional structures of controlled systems, caused by the rapid development of science, technology and production, leads in turn to a steady complication and increase of the variety of administrative tasks, excluding the possibility of their solution by traditional "manual" methods. Under those conditions the necessary quality and required level of efficiency of control are achieved by the use, directly in the sphere of practical leadership, of modern mathematical methods of solving administrative problems and of rapid computer technology.

The specifics of the activity of personnel of administrative organs (especially of higher links) consist in its removal from controlled facilities and the impossibility of directly observing the state and conditions of

functioning of executive elements of the system. Therefore in the process of performance of the control functions the personnel of the administrative organ make use of images simulating them and an information model which is realized in the ASU by means of various equipment for depiction in print.

The application of modern equipment and appropriate mathematical methods means intensification of scientific methods of management. It permits eliminating to a great degree the influence of the subjective factor on the results of generalization of operative information, substantially increases the validity of adopted decisions, considerably curtails the total length of the management cycle and puts the flow of documents in order.

Automation of the administrative processes involves intellectualization of the labor of people engaged in it; when purely mechanical processes of information processing by hardware and increase of the relative time expenditures on the logical and analytical activity of administrative personnel during a general shortening of the length of the administrative cycle.

However, this does not at all mean that in the ASU it is necessary to entrust almost all functions to the equipment. The functions of control in the system "man-machine" are usually distributed in accordance with definite criteria reflecting both requirements presented for functional characteristics of ASU's and limitations on the level of allowable expenditures. The selected distribution criteria must correspond [51] to the essence of processes taking place in an automated system, destructive features of problems solved by man, and functions entrusted to the hardware, and also to take into consideration the influence of engineering psychological factors on the quality of performance of control functions.

In the practice of planning automated information and control systems the following scheme has formed for the solution of the problem of distribution of functions between people and hardware [9,51,54,90]; functions which clearly lie beyond the limits of human possibilities must be entrusted to man; for functions the distribution of which is not self-evident, a solution is made, on the basis of the results of which a decision is made regarding the best methods of solving all the functions not explicitly allotted to man or machine.

Thus the rational combination of the creative capabilities of man and the possibilities of modern means of data processing also constitutes the essence of automated control. Automation does not minimize the role of man in the control system; on the contrary, it leads to intensification of the influence of management on the course and outcome of controlled processes, as it leads to intellectualization of its labor and increase of the validity of decisions and plans.

[410-2174]

2174
CSO: 1863

NEW USSR STANDARD FOR PUNCHED COMPUTER TAPE

Moscow PRIBORY I SISTEMY UPRAVLENIYA in Russian No 6, 1980 inside front cover

[Description of new USSR State Standard]

[Text] GOST 23415-79. Machines, computing. Tape, paper with transport perforations. General technical specifications. Standard elaborated for the first time, confirmed by resolution of the USSR STate Standards dated 12 Jan 79, valid from 1 Jan 80 to 1 Jan 85.

Goal of the elaboration is to establish types and sizes of paper tapes used as information carriers in computer printers.

The standard covers paper tape widely used in computer printers and governs the types, basic dimensions of computers, rules of take-up, monitoring methods, requirements for labelling, packaging and storage, and manufacturers' guarantees; the development is based on the requirements of CMEA Working Standard 4393-74 (tape width 180-450 millimeters, diameter of transport perforations 4 millimeters, spacing 12.7 millimeters).

Introduction of the standrd will permit the production of tape having optimum dimensions and high quality for use in computers.

[402-8617]

CSO: 1863

SOFTWARE

LIST OF SOVIET ARTICLES DEALING WITH ALGORITHMS AND PROGRAMS

Moscow ALGORITMY I PROGRAMMY in Russian No 7, 1980 pp 1-148

[Excerpts]

No 2456. Automation of planning and experimental design work in computer development. No 1: Intravuz collection/Moscow Institute of Electronic Machine Building. Moscow, 1979, 190 pages. Contents:

Pachkova, T. G., Skorodumova, I. M., and Sypchuk, P. P. The question of simulating the distribution of impurities in semiconductor structures, pp 61-62;

Gonikhin, O. D., and Mikhaylov, V. M. Distinctive features of data bank planning in an automated system for documentation management and preparation ASVID [avtomatizirovannaya systema vedeniya i izgotovleniya dokumentatsii], pp 87-89;

Mironov, A. S., and Mikhaylov, B. M. Principles of the organization of interaction and priority servicing in an ASVID, pp 90-92;

Kadiyev, A. R., Mikhaylov, B. M., and Sypchuk, P. P. Formation of document structure in an ASVID, pp 93-96;

Zacharov, V. B., Naumova, N. I., and Sokolova, T. V. Planning of technological sections and lines with the use of simulating models, pp 97-103;

Sushchinskiy, I. M. Some problems in the use of computers to solve tasks in organizing line production of radioelectronic devices, pp 104-113;

Kislitsin, V. A. Use of computers to organize the work of multi-object continuous flow lines, pp 114-121;

Voskov, L. S., Kislitsin, V. I., and Sushchinskiy, I. M. The task of formation of technological complexes, pp 122-125;

Voskov, L. S., Sorokin, A. V., and Sushchinskiy, I. M. Algorithm for determination of the optimum composition of an assembly section during the automated planning of processes of computer assembly and installation, pp 126-133;

Golubkin, V. N., Timofeyev, V. V., and Konovalov, S. M. System of machine analysis of microprogram main line structures of computer equipment, pp 134-138;

Brekhov, O. M., and Titov, S. M. Some questions of the synthesis of a multisectional memory, pp 145-150;

Rachkova, T. G., Skorodumova, I. M., and Sypchuk, P. P. Approximation program library in a machine planning system, pp 151-156;

Vashchilin, E. P., Sypchuk, P. P., and Shakula, Yu. P. Automation of the process of selecting the parameters of procedures of control of a data transmission circuit in computer networks, pp 157-163.

No 2462. Voronin, D. F. Main functions of primary and secondary indices in the multiaspect processing of data bases. VOPROSY RADIOELEKTRONIKI, SERIYA ASU, 1979, No 3, pp 42-50. Bibliography: 8 items.

Methods of data organization and control based on the introduction of secondary indexing of the structure of data base units, for example, records, are used for the effective multiaspect computer processing of large data bases. By comparative analysis the main functions of primary and secondary data base indices are revealed and the purposes of their application are examined. A classification of methods of secondary indexing is presented as a function of the methods of establishing correspondence between the primary and secondary indices.

No 2604. Mamikov, A. G., Kosyachenko, S. A., Kul'ba, V. V., and Tsvirkun, A. D. Adjustment and experimental operation of ASU program complexes. Moscow, 1979, 78 pages. Institute of Control Problems. Bibliography: 35 items.

Automation systems for the adjustment of algorithm complexes and FACES programs, intended to help in the writing, checking, modification and work of a FORTRAN program; the PACE system of automation of adjustment planning, determination of a large number of tests and monitoring their passage; interactive adjustment means of the HELPER system; the method of planning and optimization of the process of adjustment of ASU program complexes on the ICL-4-70 computer.

No 2638. Gal'perin, Yu. I., Ponomarov, Yu. N., and Sinitsyn, V. M. Some algorithms for calculation of reference geophysical information along the

orbits of earth satellites. Program directory KADR-2. Moscow, 1980, 41 pages + 7 sheet appendix. (USSR Academy of Sciences, Institute of Space Research, Preprint No Pr-545). Bibliography: 20 items.

The main components of a program directory unit and algorithms on the basis of which those units were created are described. Also described are additional program versions convenient for a single experiment with use of a limited set of principal parameters and the addition of new principles for inclusion of KADR-2 in the ARKAD bank program complex. Forms are presented for issuance of data for some versions of the KADR-2 program.

No 2649. Bodrova, L. D., Yegorov, A. A., Koshelev, V. S., et al. Complex of programs for analysis of the thermal regime of end cathode heating units with cast and uncast heaters. ELEKTRONNAYA TEKHNIKA. SERIYA 1. ELEKTRONIKA SVCh, 1979, No 12, pp 78-81. Bibliography: 4 items.

No 2738. Lisyutenko, G. V. Formalized request language for ASU data bases. VOPROSY RADIOELEKTRONIKI, SERIYA ASU, 1979, No 3, pp 60-62. Bibliography: 8 items.

A formalized request language for ASU data bases for no-programmer users is presented, one reflecting the point of view of data as sets of concepts. The language permits describing the meaning of questions in terms of concepts, attributes and functions. The classes of terms constituting the lexicon of the formalized request language and request structures are examined. Examples demonstrating the application of f formalized request language are presented.

No 2771. Shipovskaya, L. A., and Shishkin, V. I. Basic software of the M-400 computer and the "Elektronika 100/16I" dispatcher computer for their coupling with the BESM-6. ELEKTRONNAYA TEKHNIKA. SERIYA 1. ELEKTRONIKA. SVCh, 1979, No 12, pp 77-78. Bibliography: 4 items.

The basic software represents a set of extracodes accomplishing exchange of standard information control unit bytes or control words, single messages, data arrays with a length of 48 or 1056 bytes, within the framework of a single exchange logic adopted in a complex mechanical planning system.

No 2772. Novikova, L. D., Popov, M. I., Sidorov, G. I., et al. Automated system for real-time processing of radar meteorological data by means of the ASVT-M-3000 computer. Radiotekhnika: Republican Interdepartmental Scientific and Technical Collection. Khar'kov Institute of Radioelectronics, 1980, No 52, pp 117-123. Bibliography: 6 items.

A description is given of the technical realization of a communication channel between an MRLS-2 and an M-3000 computer, one which accomplishes automatic pulsed processing of echo signals. Block diagrams are presented of programs for data input into computers and calculation of real- or quasi-real time echo signal static characteristics.

No 2775. Girgor'yev, V. N., Guman, V. N., and Prigozhin, S. A. Organization of work with libraries and job control on an M-4030 computer in the ASVT DOS [modular system of computer technology disk operating system]. Materials on Software, Leningrad, 1979, 59 pages (USSR Academy of Sciences, Physico-technical Institute, Preprint No 640). Bibliography: 3 items.

A modification of the JCS (Job Control System), the DOS ASVT, and organization of library files on disks are described. Creation of the job control macrolanguage permitted developing a complex of catalogued procedures convenient for users.

No 2800. Kovalenko, V. V., and Polyarov, A. B. Computer calculation of the noise factor of bipolar uhf transistors. ELEKTRONNAYA TEKHNIKA. SERIYA 2. Semiconductor Instruments, 1979, No 1, pp 105-112. Bibliography: 6 items.

The article describes an algorithm for calculation of the noise factor of bipolar uhf transistors from their equivalent circuit for low-signal and primary noise parameters, implemented on a BESM-6 computer. Formulas are given for converting the primary noise parameters during connection to an internal four-pole of series impedances and parallel admittances. The program has a read-out time of several seconds.

No 2818. Duvakin, A. P. Estimate of the efficiency of the software accompaniment service. VOPROSY RADIOELEKTRONIKI. SERIYA EVT, 1970, No 10, pp 38-46. Bibliography: 5 items.

No 2822. Kolochkov, Yu. M. Data processing system for tasks in material resources control. VOPROSY RADIOELEKTRONIKI. SERIYA ASU, 1970, No 3, pp 34-41. Bibliography: 3 items.

The conception of system construction on a YeS electronic computer is presented, as are specific criteria for work evaluation.

No 2831. Tsenilov, G. A. The question of the technology of application of the "KAMA" package of applied programs to create real-time systems. VOPROSY RADIOELEKTRONIKI. SERIYA EVT, 1979, No 10, pp 87-96. Bibliography: 4 items.

No 2832. Construction of a microcomputer cross assembler on the basis of YeS EVM Assembler macro-hardware. VOPROSY RADIOELEKTRONIKI. SERIYA EVT, 1979, No 13, pp 91-98. Bibliography: 6 items.

A simple method is given for the creation of a cross-assembler of a 16-digit electronic computer which utilizes maximally YeS operating system resources and possibilities.

No 2841. Aleksanyan, I. T., Krivoshapko, V. M., and Romanov, A. A. Construction of a model of parametric reliability of integrated circuits from data on degradation of their characteristics and simulation of tests on a computer. ELEKTRONNAYA TEKHNIKA. SERIYA 3. Mikroelektronika, 1979, No 1, pp 15-19. Bibliography: 8 items.

A method is presented for estimating quantitative indicators of integrated circuit reliability. Machine time expenditures on the YeS-1030 computer for that stage of the degradation model is 3 hours, and for the stage of test simulation is about 1.5 hours.

No 2873. Morev, V. A., Bol'shakov, S. A., Chernen'kiy, S. B., and Spiridonov, S. B. Investigation of algorithms for distribution of tasks to computer centers in a centralized computer network on a simulator. VOPROSY RADIOELTRONIKI. SERIYA EVT, 1979, No 10, pp 97-105. Bibliography: 1 item.

The simulator in the STAM/KLASS language is oriented toward simulation of complex computer systems and networks of computers with great dimensionality.

No 2918. Kozlova, S. B., and Gavryutina, N. M. Improvement of methods of planning revenues in transport. Trudy/Institute of Complex Transport Problems under the USSR Gosplan, 1979, No 75. Questions of Improvement of Planning Methods and the System of Transport Development Indicators, pp 120-130. Bibliography: 2 items.

On the basis of methods used in ASPRT creation algorithms and programs were compiled for Wang mini-computers for planning revenues of the main operating activity of rail, sea, river, truck and air transport. The algorithm for solution of the problem for sea (coastal) and river transport is based on report forms MT20 and RT20.

No 2944. Multiprocessor computer systems (MVS) with a common order flow. Collection of articles. Institute of Control Problems. Moscow, 1978, 105 pages. Bibliography at end of articles.

The collection deals with the principles of MVS construction and describes order and control systems, the organization of the computational process,

including the elimination of duplication of group calculations, ordinary differential equations, dynamic programming, statistical data processing and mass service systems.

[24-2174]

2174
CSO: 1863

MORE SOVIET ARTICLES ON ALGORITHMS AND PROGRAMS

Moscow ALGORITMY I PROGRAMMY in Russian No 8, 1980 pp 1-122

[Excerpts]

No 2948. Automated planning of discrete control devices. Institute of Control Problems, USSR Academy of Sciences. Moscow, Nauka, 1970, 211 pages. Bibliography at end of articles.

The creation by the Institute of Control Problems in the USSR of a "Display-dialog system of automation of planning" and by the Central Institute of Cybernetics and Information Processes in the GDR of "System of computer planning of discrete control devices" [RENDIS--original language version unknown]. Special languages have been developed to describe algorithms of the functioning of discrete devices and systems.

No 2949. Bezhanova, M. M. Planning specifications for packages of applied programs. Novosibirsk, 1980, 45 pages. (USSR Academy of Sciences, Siberian Department Computer Center Preprint No 225). Bibliography: 30 items.

A measure of improvement of the quality of packages of applied programs and standardization of requirements for them. The meaning and allowable values of the specifications are described. The functional characteristics and technical-system characteristics are a result of the preliminary plan.

No 2954. Gushin, O. K., Gnesina, P. R., and Kalachev, A. S. Questions of the organization of KASPI system software. Moscow, 1970, 8 pages (USSR Academy of Sciences, Institute of Precision Mechanics and Computation Techniques, Preprint No 19).

The KASPI computer software has two parts: a permanent part with recording in the region of the carrier blocked by the equipment and a variable part --recording opened up by the equipment. The software occupies a volume of about 5.5 Mbytes.

No 3029. Standardized COBOL. Minsk, 1980, 158 pages (YeS EVM Small Operating system, Belorussian SSR Academy of Sciences, Scientific Research Institute of Electronic Computers, No 23). Bibliography at end of articles.

Various aspects of the use of two standardized COBOL packages of applied programs for disk operating systems and operating systems are discussed. The packages contain a translator and a program library connected with it for a Russian variant of a standardized COBOL language.

No 3142. Interactive system of the Institute of Space Research, USSR Academy of Sciences. Anan'yev, A. V., Novosel'tsev, S. K., Orlov, I. G., and Semchishena. Moscow, 1980, 39 pages (USSR Academy of Sciences, Institute of Space Research, Preprint No Pr-527). Bibliography: 4 items.

The syste an expanded version of the 2.0-2.2 YeS disk operating system, which as s the execution of tasks in package regime in two YeS disk operating system sections and access of users to YeS EVM resources from 10 subscriber points equipped with displays.

No 3143. Some general-purpose programs for the HP-9830 calculator. Moscow, 1980, 49 pages (Institute of Atomic Energy, Preprint No 3231/15). Bibliography: 3 items.

Programs are presented in the BASIC language; construction of graphs on coordinate files stored in the main memory--PLOT; read-out of drawings from the digital input device--DIGITIZER; remembering them on an external carrier and in any scale on a plotter--DIGITIZER-PLOTTER; construction of space curves in any projection--SPACE CURVE and construction of projections of surfaces given by coordinate files--SPACE SURFACE, and two programs calculating the values of the gamma-function of any real argument and the Bessel function of any order of a positive argument.

No 3171. Yershov, V. A., and Irbenek, V. S. Two-stage layout algorithm. Moscow, 1980, 17 pages (USSR Academy of Sciences, Institute of Precision Mechanics and Computer Techniques, Preprint No 6). Bibliography: 4 items.

A complex of programs in the autocode of an instrumental electronic computer for the layout and evaluation of a circuit included in the KASPI small operating system is described. The program volume is about 2000 machine words.

No 3203. Bondar', A. Yu., Vayser, B. I., and Numerov, V. S. Organization of the YARMO-BESM-6 translator. Moscow, 1980, 13 pages (USSR Academy of Sciences, Institute of Precision Mechanics and Computer Techniques, Novosibirsk, Preprint No 9). Bibliography: 3 items.

The translator consists of units for translation and the obtaining of an object module. The translator programs are written in the first version of the YARMO language using translating tables.

No 3204. Bondar', A. Yu., Kurlyandchik, Ya. M., and Razgudin, V. B. Component segmentation and interaction. Moscow, 1980, 20 pages (USSR Academy of Sciences, Institute of Precision Mechanics and Computer Techniques, Novosibirsk branch, Preprint No 14). Bibliography: 2 items.

Means of maintaining segmentation of the complex Integral assure the functioning of programs, the total size of which exceeds that of the addressed main memory of the BESM-6.

No 3205. Vayser, B. I., and Cheblakova, T. F. Retranslation of separate units. Moscow, 1980, 20 pages (USSR Academy of Sciences, Institute of Precision Mechanics and Computer Techniques, Novosibirsk branch, Preprint No 12). Bibliography: 8 items.

A retranslator makes it possible, during the introduction of local changes into the text of a large program, to translate only a fragment of a program affected by changes and to enter the composition of a translator with the YARMO language.

No 3210. Numerov, V. S., and Cheblakov, B. G. Realization of syntactically controlled open substitutions. Moscow, 1980, 13 pages (USSR Academy of Sciences, Institute of Precision Mechanics and Computer Techniques, Novosibirsk branch, Preprint No 11). Bibliography: 5 items.

No 3213. Tarasenko, L. G. Data-base control network-system. Moscow, 1980, 16 pages (USSR Academy of Sciences, Institute of Precision Mechanics and Computer Techniques, Novosibirsk branch, Preprint No 10). Bibliography: 3 items.

A data-base control system network was realized within the framework of the operating system of an El'brus-1 special processor and the DISPAK operating system of the BESM-6.

No 3214. Ternovaya, N. P., and Cheblakov, B. G. Syntactic apparatus of a YARMO translator. Moscow, 1980, 27 pages (USSR Academy of Sciences, Institute of Precision Mechanics and Computer Techniques, Novosibirsk branch, Preprint No 10). Bibliography: 6 items.

No 3221. Kobelev, V. V., Fedorova, K. Ya., and Churinova, L. V. Operative planning unit of the DZHIN interactive system. Moscow, 1980, 24 pages (USSR Academy of Sciences, Institute of Precision Mechanics and Computer Techniques, Preprint No 8).

The DZHIN system for the BESM-6 works under control of the DISPAK operating system in a disk variant to monitor the execution of decisions of [illegible] technical conferences.

No 3227. Kurlyandchik, Ya. M. File control systems. Moscow, 1980, 21 pages (USSR Academy of Sciences, Institute of Precison Mechanics and Computer Techniques, Preprint No 13). Bibliography: 7 items.

A file control system is realized in the form of a module in the YARMO language.

No 3229. Gurevich, V. L., Gol'dberg, S. I., and Pronin, I. A. Substantiation of the selection of an algorithm for recognition of the character of brain insult. Trudy of Moscow Medical Institute II, 1980, Vol 136. Medical and Biological Cybernetics. Problems of Remote Diagnosis and Remote Processing of Medical Information, No 5, pp 53-57. Bibliography: 2 items.

No 3236. Questions of the creation of automated control systems for planning calculations. Collection of scientific works. (USSR Gosplan, Main Computer Center, No 31. Software of the second automated control system for planning calculations (ASPR) line. Moscow, 1979, 142 pages. Contents.

Kovalevich, E. V., Tsagel'skiy, V. I., and Chuprigina, L. T. Possibilities and prospects of development of the YeS EVM operating system, pp 3-21;

Kovalevich, E. V., Kozlovskaya, Ye. A., and Chuprigina, L. T. Means of time sharing in a YeS operating system, pp 22-26;

Brich, Z. S., et al. FORTRAN language programming system for time-sharing regime, pp 27-32;

Brich, Z. S., Itkina, O. G., and Tsagel'skiy, V. I. Interactive adjustment of program in FORTRAN, pp 33-37;

Bykova, V. P., et al. Programming system based on the state standard of the COBOL language, pp 38-44;

Skripnikova, V. M., and Fel'dman, L. S. Interactive adjustment of program in COBOL, pp 45-47;

Isayeva, N. S., Sukhikh, L. P., and Shiller, F. F. Some questions of the preparation for use and operation of the YeS EVM operating system in the USSR Gosplan Main Computer Center, pp 48-51;

Plyasuke, Yu. A. Operation of the Unified System operating system in the organization of work in the Estonian SSR Gosplan Computer Center, pp 52-54;

Borimechkov, M. R., Burov, N. L., and Labutina, V. V. System of records of YeS EVM resources, pp 55-56;

Antoshin, V. N. Improvement of the record of YeS EVM use, pp 57-62;

Burov, N. L., et al. Module file management system, pp 63-69;

Labutina, V. V. Service programs, pp 70-74;

Gemu, A. K., et al. Data processing means of the "Ekonomist--YeS operating system," pp 75-91;

Garin, I. V. One approach to data processing in economic planning calculations, pp 116-132;

Makhmudov, S. Ya., Stepanyants, G. A., and Byal'skiy, M. A. Application of the method of integral programming in planning a complex of ASPR hardware, pp 133-137.

Materials of the seminar "Questions of YeS operating system use in the computer center system," held at Minsk, are presented.

No 3347. Package of programs for process control computer complexes, problem-oriented toward economic applications, based on the SM-3 and SM-4 (PEKO SM EVM) on the basis of the Small Computer Disk Operating System: Brief description of application/Soyuzsistemprom. "Tsentroprogrammsistem" Scientific and Production Association, Kalinin, 1980, 8 pages (Industrial Methods of ASU Creation).

The article describes a package of SM EVM for processing small volumes of information of an economic character in the form of linear files with recordings of fixed data.

No 3348. Structural organization of SM EVM processors and computer complexes. Moscow, 1979, 126 pages (Trudy/Institute of Electronic Control Machines, No 77). Bibliography at end of articles.

No 3353. Tarasenko, L. G., and Yantsen, V. I. Files and archives in an operating system. Moscow, 1980, 20 pages (Institute of Precision Mechanics and Computer Techniques, Novosibirsk, Preprint No 16). Bibliography: 4 items.

A system of files and archives within the framework of the operating system of the special processor of an El'brus-1 MVK and a modular operating system

for the BESM-6 computer is intended for organization of the work of users with information arranged on external stores (magnetic drums, disks or tapes).

No 3354. Tsang, F. R. Operating system of the special processor of the El'brus-1 MVK. Moscow, 1980, 27 pages. (USSR Academy of Sciences, Institute of Precision Mechanics and Computer Techniques, Preprint No 15). Bibliography: 6 items.

A special processor assures compatability of the El'brus-1 MVK and the BESM-6 computer by passing to the MVK programs on a BESM-6 in an unprivileged regime. The special processor of the operating system assures the required compatability by identical interpretation of extracodes.

[414-2174]

2174
CSO: 1863

UDC 003:(744.4.001.2:681.3)

'NONIUS' LANGUAGE FOR INPUT AND EDITING OF GRAPHIC INFORMATION

Moscow PRIBORY I SISTEMY UPRAVLENIYA in Russian No 6, 1980 pp 11-13

[Excerpts from article by B. M. Bogdanov, dr. of technical sciences and N. M. Ovchinnikov]

[Excerpts] Several input lnaguages have been deen developed which permit graphic information (GI) to be descrbied in the form of a text which is then translated by the translator into some internal representation [1]. Attempts have also been made to design GI input and editing languages using graphic displays [2-7].

Current languages and methods of GI which permit description of GI with the aid of graphic displays have three basic shortcomings: the hierarchy of image elements is not developed, the accuracy of element position indication on the screen and the set of instructions are inadequate.

"Nonius" language is free from these shortcomings.

"Nonius" language has been realized and successfully used since 1974 in the operating system of automated designer work sites [8] based on the "Elektronika-100/n" computer and UGD-43-1 graphic display in SAPR of parts of machine construction profile and multiple layer printing plates. Computer capacity of the "Elektronika-100/n" minicomputer has not yet permitted realization of the operations of the group of refining conversions; since the UGD-43-1 display lacks a circle generator, the basic concepts do not include the element "arc".

When the language is realized on larger computers, especially on SM computers, these shortcomings can easily be eliminated.

[402-8617]

CSO: 1863

UDC 65.012.122:681.34

CONVEX BLOCK PROGRAMMING IN HYBRID COMPUTER SYSTEMS

Moscow AVTOMATIKA I TELEMEKHANIKA in Russian No 8, 1980 pp 142-150

/Article by N. A. Karpinskaya (Moscow): "Solving the Problem of Convex Block Programming in a Hybrid Computer System"/

/Excerpts/ An algorithm for solving problems of convex block programming in hybrid computer systems is proposed. The method is checked in problems of scheduling in petroleum refining.

1. Introduction

The majority of problems of optimum planning are formulated as problems of mathematical programming, the solution of which with a sufficient degree of accuracy often makes it possible to obtain a significant economic impact. Many problems of the optimum preparation of petroleum products are reduced mathematically to problems of convex block programming. These problems, particularly the problems of scheduling, are characterized by a large number of similar blocks (20-40) and a large overall dimension of the problem (250 X 150).

It is well known that on an analog computer it is possible to solve complex nonlinear problems of optimization with sufficient accuracy, but the dimension of the problems being solved is limited. When solving such problems on an analog computer a gain in solution time is obtained as compared with a digital computer.

Hybrid computer systems (GVS's) are made up to a high-speed digital computer, an analog computer of improved accuracy and a device for the high-speed exchange of data between the digital computer and the analog computer. In this connection the study of the possibility of solving in hybrid computer systems problems of convex block programming of a large overall dimension, but with a small block dimension, is of great interest. The problem of scheduling is one of the problems which can be effectively solved in hybrid computer systems.

4. The Solution of the Problem of Scheduling on the GVS-100

The program of the solution of the problem was written in Fortran and Autocode. Each part of the program was drawn up as a separate subprogram. Therefore it is possible, without changing the entire program, to replace individual parts. Such a need may arise, if the structure of the problem is partially changed, for example, the structure of the overall block or the method of solution is changed, in particular the solution of the block might be found on a digital computer or by another method on an analog computer. Then it is possible to insert in place of the existing program a new program with the same input and output parameters.

A solution was made for a block measuring 6 X 5. There were four such blocks in each calendar period (four brands of gasoline), three calendar periods were examined. The overall dimension of the problem is 72 X 204. One of the examined blocks is cited below as an example.
/21-7807/

7807
CSO: 1863

USES FOR PROGRAM OPTIMIZATION

Moscow PROGRAMMIROVANIYE in Russian No 2, 1980 pp 27-31

[Article by V. N. Kas'yanov and I. V. Pottosin: "The Technological Possibilities of Program Optimization"]

[Text] This paper considers the possibility of using the techniques of program optimization for technological purposes at all stages in the life of a program from its automated design to the generation of program documentation and modifications during maintenance.

The purpose of this paper is to investigate to what extent the existing methods and techniques of program optimization can be used in the technology of the creation of program production (this has already been partially discussed in [1-3]). In this discussion, we assume that the problem of technological program tools is one of the most important problems in the automation of programming technology. This is discussed [4].

The typical domain in which program optimization is used is translation, in the process of which a flow-chart analysis of the translated programs is performed and the results used either for an efficiency-oriented realization of the supplementary semantics of the program design, or for improvement of the algorithm represented. Flow-chart analysis of the program, as distinguished from translation (syntactic and semantic) analysis, is understood to mean analysis of the flow of control and data in executions, which are determined by the text of the translated program, with the purpose of obtaining reliable information about the behavior of the program for the whole set of initial data. The optimizing conversions applied during translation (as distinguished from the translation conversions which are related to the translation per se, i.e., to changes in language level and thus must retain in its entirety the semantics of the program designs) are oriented toward retaining the meaning of the program as a whole and always alter local semantics.

The technological role of an optimizing translator in increasing the efficiency of programs is well-known. Here we will try to show that the methods of program optimization being developed possess additional potential capacity

and can also be used not only for increasing efficiency but also for increasing the reliability, readability and comprehensibility of programs, i.e., can be used for technological purposes at virtually all stages of the life of a program--from its automated design to the creation of program documentation and modifications during maintenance.

This additional potential capacity follows from the fact that the flow chart analysis of programs gives rise to certain statements about the program, its segments and features of the data, while the conversion of programs has as its real purpose, not the efficiency of the program per se (a criterion which is met at the level of maintenance), but the achievement of certain technological features of the program, its segments and data. Here, while analyzing or converting a program, we are dealing not only with a text frequently reflecting algorithmic operations (the program per se), but also with a system of statements which accompany the program, which reflect the characteristics and features of the values of the data and the execution of program segments. We can speak of a system composed of the program text per se and the annotation related to its segments--i.e., the annotated program [3], which is considered in optimization as a single whole, as the argument and result of optimization.

We will consider the concrete possibilities for using optimization methods and techniques at various technological stages of the generation and life of programs. In particular we will consider how the relationship between optimization techniques and annotated programs as well as the capacity of optimization methods to yield reliable information about the behavior of programs and to generate programs with given characteristics, create the preconditions for using accumulated experience in program optimization to obtain statements about the program (for testing, debugging and documentation) and to create program texts (for automated design, modifications and conversion).

1. The design of the program text. We will use the term program text to mean the visible and understandable text, as distinguished from the internal (machine) text, which is directly executed. In other words, we relate the term "program text" with the text of the program in programming language and will assume that this text is converted into an executable one automatically. The role of optimization in such a conversion is obvious and traditional. The program text, as a rule, is constructed by hand, although there are a number of technological tools, for partically automating this process--editors, macrogenerators, etc. Technological tools have been developed which make it possible to a significant degree, to automate the creation of program texts--converters, which translate a text from one programming language to another (for example, in converters of ALGOL-60 to PL/1 and ALGOL-68), concretizors which convert texts within a single programming language [5], synthesizers which create a program text to meet specifications--preprocessors for applied program packages (for example, [6]). In the future, the use of such devices and tools will grow materially and, to a significant extent, will aid in automating the process of creating program

texts. In addition it is evident that if the methods and techniques of optimization are made organic parts of these tools, this will increase their efficiency and broaden the range of possibilities for their use. The use of optimization in convertors is completely analogous to its use in traditional translators (since convertors can be considered a special case of translators). We note only the necessity for using flow-chart analysis in convertors as a mixed strategy in a translation whose purpose is to eliminate redundancies connected with either the level of display devices or the universality of the source material. The functions of concretizors essentially involve optimizing conversions of the program text. However existing concretizors (and in particular [5]) transform the program text only by eliminating redundancies which clearly exist in this text, i.e. by reducing the program [2]. The reduction of a program may, nonetheless, turn out to be a very effective process in assembling a program text from segments or subprograms [2]. The process of reduction involves the sequential construction of certain annotations which are used for the conversion of the program text. This technique naturally makes expansion possible because of the inclusion in the source program text of the initial annotations of this type, which are used in the generation of the following annotations and thus participate in the generation of the resulting annotated program. A concretizor in such a case becomes a tool for the creation of a program text from a source with given assumptions about the source data, the behavior of the program or its individual segments etc. These assumptions can be made either directly by the programmer or can be constructed in some automated way from a known context for program use, formulated external specifications etc.

Because of the variety of types of synthesizers, a portion of them (at any rate, according to the way optimization methods and techniques are used) may be considered to be convertors, and a portion concretizors. It is essential to note that one of the tasks of the synthesizor may be the synthesis of annotations from their specification in terms of the problem domain.

2. Verification and debugging. We will relate the term debugging to the dynamic checking of certain sets of initial data (test sets). By verification we mean the checking of the correctness of the program on the basis of the program text.

The extent to which a program is checked during debugging depends materially on the number of test sets. One may speak about the completeness of test sets in relation to the extent to which the executions for these sets realize all the possible transitions in the program. It is obvious that for the automated construction of complete or nearly complete sets one can use the methods of flow-chart analysis of test programs. Flow-chart analysis can yield some means for constructing the sets for selective testing, based on certain selected features of the executions (passing given points of the program, work with given objects etc.)

The ideas which are being developed now for using a symbolic execution for checking programs, can be applied to the generalization of symbolic execution to all possible executions or to a given set of them. The results of symbolic executions themselves can be used an annotations accompanying the program text.

Syntactic and semantic analysis, which is performed during translation, makes it possible to locate syntax and semantic errors. Moreover, a portion of the semantic errors are revealed only on execution and in such cases the resulting text may contain a special sign to signal that there is an error. This type of check may be reflected through special annotations, which, if contradicted, indicate that the semantics have been violated. It is well known that optimization may reveal a number of substantive errors which also have their corresponding special type of annotation. The deveopment of this methodology for obtaining special verification annotations indicates that the use of optimization methods and techniques with programs (including annotated programs) can reveal a rather broad class of contradictions which are indicative of errors [1].

Contemporary technology for automatic checking of the correctness of a program is based on the introduction of statements and invariants, which in essence represent annotations, containing, as a rule, deeper and more exhaustive information about the features of the entities and segments of a program. The fact that this approach corresponds to a consideration of annotated programs during optimization makes it possible to combine optimization techiques with techniques for checking the correctness of programs, for the purpose of optimization itself, as well as for verification.

3. Documentation. Among the tasks of documentation are the tasks of making clear the information processing/logical structure of the program and the task of providing the program segments with comments. The information processing/logical structure of the program is represented as a hierarchy of included segments with an indication of the control relationships within a segment and the flow of information through each segment including the input and output data for each. A HIPO-diagram is an example of such representation. Moreover, one of the main tasks of flow-chart analysis is precisely the idenitification of such a hierarchy, and also of the information-processing and control connections. For the purposes of documentation it is enough to explicitly present the flow-chart analysis of the information-processing/logical structure obtained. Other information-processing/logical relationships, used in documentation, as, for example, cross reference, can be obtained on the basis of the methods of flow-chart analysis.

Comments in the program are to a significant extent analogous to annotations. The meaning of the invariants in a loop, for example, are important for purposes of documentation. Including the annotations obtained on the basis of optimization methods and techniques in a program, increases the degree of self-documentation in a program.

We note that the optimization process can involve an altereation of the program's information-processing/logical structure in a direction useful for documentation, chiefly by regularization of the program structure, including the elimination of superfluous jumps, multiple entries into a loop, etc. which detract from the clarity of operation, and also locating common subsegments, improving the comprehensiblity of the important information processing relationships—partition of the domains of operation, alteration of the data structure etc.

4. Maintenance. Maintenance of the program is related to its evolution, and with alterations and modifications of the program under the influence of actual experience in using it. The modified versions of a program which are generated in the course of evolution require that the documentation and test sets be modified. This can be accomplished by the optimization methods referred to above.

One of the trends in the evolution of a program is its adaptation to the typical user. This is accomplished through the concretization indicated above.

Optimization techniques make it possible to increase the reliability of the changes introduced into a program by means of indicating, for each change, the information processing/logical relationships affected by it. The evolution of a program as a system may lead to the appearance of new program units, or the merging or decomposition of old ones. All this of necessity requires a new structure and the reconstruction of the annotated program text of the units affected. This can be accomplished automatically on the basis of optimization technology.

5. Technical planning. At the present time there are virtually no program tools for the technical planning stage (with the possible exception of simple text editors). However, the necessity for automating the checking and co-ordinating of solutions involved in technical planning has long been realized. It seems obvious that flow-chart analysis may be effectively used for checking the agreement of the external specifications for the units of a program system, of the interfaces of these units and for automating the construction or refinement of the external specifications for new program units, for visual representation of the general information processing/logical structure of the whole program system and its study.

Creating a program system may substantially increase the reliability of the stage by stage development of the units of a program system, which express the relationships among the existing elements and those which are only specified through annotation (in the future these annotations may be used to automatically generate checks on coordination with the context of use, which may be disrupted in the course of optimizing transformations).

References

1. V. N. Kasyanov, I. V. Pottosin. Application of optimization techniques to correctness problems.--Constructing Quality Software (Proc. IFIP Work. Conf.), North-Holland Pub. Co., 1978.

2. I. V. Pottosin. On the role and methods of program optimization.--Collect.: Perspectives of Development in Systems and Theoretical Programming in Novosibirsk, VTs SO AN SSR (Computer Center of the Siberian Division of the USSR Academy Sciences), 1978.

3. V. N. Kas'yanov. A practical approach to program optimization.--Preprint No. 135. Novosibirsk, VTs SO AN SSR, 1978.

4. V. M. Glushkov, I. V. Vel'bitskiy. Programming technology and problems of automation.--Control systems and machines, 1976, No 6, 75.

5. P. B. Schneck, E. Angel. A. Fortran to Fortran optimizing Compiler.--The Computer J., 1973, 16, No. 4.

6. D. Smith. GPL/1--a PL/1 extension for computer graphics. AFIPS Conf. Proc., Spring Joint Comp. Conf., 1971, 39, 511.

[8044/0004D-9285]

9285
CSO: 8044/0004D

APPLICATIONS

UDC 681.3.008:65.015.2.003.13

STANDARDS OF TIME CONSUMPTION AND FEES FOR SERVICES OF COMPUTER CENTERS

Moscow PRIBORY I SISTEMY UPRAVLENIYA in Russian No 6, 1980 pp 38-40

[Excerpts from article by V. I. Maksimenko, V. M. Simchera and Ye. P. Luk'yanov]

[Excerpts] A great deal of experience has been gained in the USSR in the use of computers to solve various problems of accounting, planning and control. The foundations were laid back in the 8th Five-Year Plan when more than 400 ASU were introduced in the country. Since then 3,100 ASU and more than 3,000 computer centers (VTs) of various purpose have been put into operation. Today the distinctive feature is that automated systems in addition to mass systems solve important, unique problems of optimum planning and control.

In converting operating VTs to cost accounting (today more than 1/3 of operating VTs are operating thus),enlarging the list of services and expanding the practice of computer user queueing, the solution of this important problem takes on particular significance.

Nowadays, we feel, the need has ripened for elaboration of standardized USSR-wide fees for VTs services to provide identical conditions of efficient operation of all information services, regardless of their status, nature of activities and agency affiliation. For each kind of operation and service, costs and fees should be established on the basis of average expenditures throughout the country for their execution.

The All-Union Scientific Research Institute of Problems of Organization and Control developed and submitted a plan "Unified classification of work and services of ASU and VTs". According to the plan, all work and services of ASU and VTs are subdivided into 10 groups (services according to pre-plan service of ASU and VTs; formulation and formalization of jobs; collection, processing, storage and transmission of data; information and programming support of VTs; technical maintenance and repair of hardware; leasing; services for personnel training, etc.), in the framework of each of which 10 to 12 specific kinds of services are spelled out. The classifier contains a total of more than 100 different operations and services.

The leading organization in elaboration of fees and prices for computer operations is the All-Union Scientific Research Institute of Problems of Organization and Control, which has been called upon to concentration the

efforts of leading VTs and NII on comprehensive solution of these questions based on elaboration of a standard classifier of computer operations and services and standardized norms of execution.

Until completion of this work, it is necessary to establish a temporary price list of standardized fees for services of VTs. The USSR State Committee of Prices put into effect a new price list in place of the effective one used for the past two years in which it contains both standardized payments for machine hours by type (seven types), discounts and surcharges for additional services (seven types).

The new price list is being sent out to all VTs, regardless of the nature of their work and agency affiliation, as well as to other organizations having and operating computers on the same basis. In contrast to the previous price list, the following separate payment schedule for computer time has been adopted:

Computer type	fee for machine hour according to price list, in rubles	
	1977	1979
"Minsk-22", "Ural-14"	30	30
"Ural-16", M-222	35	35
"Minsk-32", M-6000 (third configuration)	35	35
YeS-1020	80	70
M-4030	--	85
YeS-1022	85	85
YeS-1030	90	85
YeS-1033	100	90
YeS-1040	200	110
BESM-6	100	100

The rates are established on the basis of average sector expenditures related to the number of personnel for technical maintenance of computers and operation of standard mathematical support (MO), depreciation of hardware and plant, expenditures for materials, electrical energy, number and leasing of VTs buildings, social security deductions, administrative and other expenses per machine hour of useful computer time.

Useful machine hours of computer time implies activities of the VTs operator in carrying out calculations in user programs with standard MO and technical maintenance of all VTs devices, as well as work on mathematical and information software for the jobs. Useful time includes computer malfunctons due to the user.

Calculations between the VTs and the user are done according to the indicated fees based on the completed work document which is drawn up according to entries in the computer operation accounting journal. In automatic recording of computer operations, provided by a special program, calculations are done on the basis of data on the output forms. The user transmits the necessary information for calculations to the VTs on computer media.

The fees of the price list are calculated on the basis of the standards of average daily computer load approved by USSR State Planning and the USSR Central Statistical Administration. Calculations took account of the use of the total computer complex of each type in conformity with the configuration envisaged by the price list "Wholesale prices for computer hardware" and additional price lines.

If necessary, when solution of a problem requires the use of additional devices (more than the configuration envisaged by said price list), the cost per machine-hour is increased based on the specific cost of the additional devices employed. The same thing occurs when the user receives additional services. The price list provides the following add-ons and discounts for the cost of a machine-hour of the basic computer configuration.

1.
1. Content and servicing of mathematical and information support of the user including complete technical care of mathematical and information support of his jobs, storage in the VTs on computer media: add 5 percent.

2. Expansion of standard MO, access to systems libraries and applied program packages of the VTs operation under control of the main operating system: add 5 percent.

3. Execution of urgent work: calculations completed within 24 hours: add two percent; calculations and print out during the day (from 8 am to 7 pm on the same day as delivery of data): add five percent; the same thing at night: discount 15 percent.

4. Remote processing of data from terminals (user stations) by means of open access of users to MO and data transmission control devices: on a previously agreed schedule: add 10 percent; with free access to computer resources: add 15 percent.

Payment for computer center services not envisaged by the current price list or rendering of VTs services outfitted with imported computers is done according to fees calculated based on the planned cost and profitability, not to exceed 15 percent. If the computer center is operating in the multiprogram mode, calculations with users are done upon request.

Finally, the proposed price list is a temporary measure which will hardly solve all the problems related to the operation of VTs and ASU and calcualtions with users.

[402-8617]

8617
CSO: 1863

SPECIAL RULES FOR DELIVERY OF COMPUTER EQUIPMENT REVIEWED

Moscow BYULLETEN' NORMATIVNYKH AKTOV MINISTERSTV I VEDOMOSTEY SSSR in Russian No 4, 1980 pp 36-42

[Enactment: "Special Conditions for Delivery of Instrument Making Products"]

[Excerpts] These Special Conditions were ratified by decree No 5/33 of 29 April 1971 of USSR Gossnab and the State Committee for Arbritration of the USSR Council of Ministers (with supplements and amendments made by decrees No 48/57 of 21 August 1972 and No 28/8 of 8 May 1979 by USSR Gossnab and the USSR State Committee for Arbritration.

I. General Points

1. The present Special Conditions envision special features in the delivery of instrument making products by central allocation.

2. These Special Conditions apply to the delivery of the following:

a instruments for monitoring thermal energy processes;

b. general-use electrical measuring instruments;

c. instruments and machines for testing materials and measuring sizes and time;

d. geophysical, hydrometeorological, and geological exploration instruments;

e. computers, office equipment, and remote control equipment;

f. glass and porcelain instruments, apparatus, and dishes for chemical laboratories;

g. spare parts for the above articles.

IV. Special Features of the Delivery of Electronic Computing and Controlling Machines

11. If other procedures and times are not established for the parties by mandatory rules or by contract, the supplier at the time of shipping the machinery must send the recipient (purchaser) the plant certificates of the machinery, instructions on installation, and a copy of the affadavit of acceptance of the machinery by the supplier's quality control department.

12. At the time that the machine is received the recipient (purchaser), following technical specifications, must have qualified service personnel who have studied the machine and gone through special training at the supplier enterprise. For study of the machine and on-the-job training in debugging it the recipient (purchaser) sends engineers and mechanics who have specialized in computer technology on special assignment to the supplier enterprise (when it calls for them).

These representatives of the recipient (purchaser), as part of their training, participate directly in debugging the machine at the supplier enterprise.

Before the delivery date of the machinery arrives the recipient (purchaser) must prepare a special area to house it. The area must be equipped according to technical specifications and the contract.

13. Unless otherwise envisioned by contract or rules that are mandatory for the parties, the machinery is installed by the recipient (purchaser). Where necessary, the supplier provides a chief of installation of the machinery under contract conditions.

14. If the machinery is installed by the supplier, the recipient (purchaser) must accept the arriving machines from the transportation organization and store them in its own facilities, in conformity with technical specifications, and at its own cost until installation begins.

15. Large electronic computing and controlling machines and computing systems (complexes) which must be tested at the production site of the recipient (purchaser) are installed (assembled) by the supplier and turned over to the recipient (purchaser) at his site. In this case the cost of installation (assembly) is paid by the recipient in the manner and amount envisioned by the contract unless otherwise stipulated by a price list or other rules mandatory to the parties.

The supplier has the right to deliver equipment consisting of distinct installation assemblies by individual machines and assemblies in conformity with operative technical specifications, the industrial cycle, and installation conditions. This must be done in such a way that shipment of the last assembly is made at the time established for shipment of the equipment as a whole. In such cases payment for the

equipment may be made by the individual assembly, if there are properly set prices for these assemblies and payment by assembly is envisioned by the contract or rules that are mandatory for the parties.

16 When it is found that the machinery delivered does not correspond to standards, technical specifications, drawings, prototypes (models), or data contained in accompanying documents, the recipient must call in a representative of the supplier (manufacturer), regardless of whether he is located in the same city or not, to participate in further receipt of machinery and to draw up a two-party affadavit.

17. For one year from the time that the machinery is received by the recipient (purchaser) the supplier (manufacturer) is obliged, without traveling to the site, to provide advice to the recipient (purchaser) on questions of using it correctly.

A written response should be given within 10 days of receiving the inquiry.

For one year (if a longer time is not stipulated by contract) the supplier has the right to learn about the work of the machinery he delivered and to demand a report on its functioning; the purchaser (recipient) must give such a response within 10 days.

11,176
CSO: 1863

UDC 658.012.011.56.004.1:669.184

ANALYSIS OF EXPERIENCE GAINED IN RESEARCH AND DEVELOPMENT OF ASU FOR THE NUMBER TWO OXYGEN CONVERTER SHOP OF THE WESTERN SIBERIAN METALLURGICAL PLANT

Moscow PRIBORY I SISTEMY UPRAVLENIYA in Russian No 6, 1980 pp 1-4

[Excerpts from article by A. A. Belostotskiy, V. I. Solov'yev, V. P. Avdeyev, A. Ye. Koshelev and A. Ye. Merkur'yev]

[Excerts] The oxygen converter shop # 2 of the Western Siberian Metallurgical plant imeni 50-Letiye Velikogo Oktyabrya (KKTs-2/ZSMZ, Novokuznetsk) put into operation in April 1974 with two 300-ton converters is one of the largest unit-capacity plants and most modern automated converter shops in the Soviet Union in terms of the level of technology and equipment.

The high speed and intensity of the steel smelting process (duration of the blast itself is 11-13 minutes) causes an acute shortage of time that converter operators have to analyze the previous smeltings and make the necessary calculations for subsequent smeltings; and for operating personnel of the shop (dispatcher, shift boss) to make the optimum decisions in coordinating shop section work. Control is complicated by incomplete information on the process because of the lack of automatic sensors for direct sensing of several parameters chacterizing the smelting process: steel temperature in the converter, content of carbon, sulfur, manganese, etc. in the latter. This all leads to production losses, interruptions in filling of steel orders; thus the problem of creating ASU for converter production is extremely crucial.

The basic technological structure of the ASU of the KKTS-2/ZSMZ is a multi-computer complex (VK) of M-6000 control computers. The processors are interconnected via duplex registers and high-speed data transmission modules. Input/output of information in ther ASU, including connection to non-standard operating and control equipment developed by the Central Scientific Research Institute of Converter Automation (manual input sensors [DRV], graphic panels, consoles) is done with the aid of standard ASVT-M modules, permitting total standardization of all systems connections.

The ASU of KKTs-2/ZSMZ consists of three interconnected subsystems (Figure 1); an information system: collection, processing and display of data; technological steel smelting process control; operational accounting and analysis of production flow in the shop.

Organization of Research and Development of the System

The ASU of KKTs-2/ZSMZ is one of the first ASU in the country which operates in real time. Its design required the coordinated efforts of many scientific research, planning, construction and assembly and debugging organizations, as well as plants and enterprises of the Ministry of Instruments and other agencies. The leading organization in design of the ASU of KKTs-2/ZSMZ was the Central Scientific Research Institute of Converter Automation. Research and incorporation of the system were implemented in comparatively short periods (1972-1975).

The annual economic effect of ASU incorporation at KKTs-2 in 1976-1978 averaged about 500,000 rubles, because of a 15 percent increase in the number of smeltings produced from the first rolling; a 13 percent increase in lining stability and rhythmic operation of steel smelting and rolling production and several other factors.

One of the main results of incorporating the ASU of KKTs-2 is the surmounting of the "mental" barrier among technological shop personnel who believed in the system and performance of several functions, e.g., formulation of the smelting certificate is no longer thought of without the use of the ASU.

[402-8617]

8617
CSO: 1863

UDC 681.322:621.774.3

ADAPTIVE CONTROL SYSTEM FOR PIPE ROLLING PLANT WITH AUTOMATED MILL

Moscow PRIBORY I SISTEMY UPRAVLENIYA in Russian No 6, 1980 pp 5-7

[Excerpt from article by A. A. Rurua, engineer]

[Excerpt] The increasing intensity of pipe production, pipe quality and reduced losses of metal are directly related to the elevated level of automation of the hot rolling process of pipe. In pipe rolling production, adaptive control systems are becoming widely used [1]. In the Soviet Union, an automated control system for the process of hot rolling of pipes using an adaptive method of control for the pipe-rolling plant (TPA) with a three-roller rolling mill was first developed by the Institute of Control Problems (Moscow), The All-Union Scientific Research and Planning Institute of the Automation Industry (Rustavi), and the Pervoural'skiy New Pipe Plant (PNTZ) and was put into TPA 160 based on UMI-NKh-M control computers.

[402-8617]

8617
CSO: 1863

PUBLICATIONS

ABSTRACTS FROM THE JOURNAL 'AUTOMATION AND COMPUTER TECHNOLOGY'

Riga AVTOMATIKA I VYCHISLITEL'NAYA TEKHNIKA in Russian No 4, 1980 pp 95, 97, 99

UDC 681.3.06

INTERACTIVE SYSTEM FOR SIMULATION OF DEVELOPING COMPUTER SYSTEMS

[Abstract of article by Pirogov, V. V., and Khaykin, I. A.]

[Text] The software of an interactive system for the simulation of developing computer systems is described, as are the opportunities presented to the investigator by it and specifics of the interactive procedure. A technological circuit for data processing in an interactive simulation system is proposed. An example of the solution of a certain problem of simulation is presented.

UDC 519.217:681.5

NUMERICAL METHOD OF ANALYZING COMPUTER ASSOCIATIONS USING A TWO-DIMENSIONAL MARKOV DESCRIPTION

[Abstract of article by Andronov, A. M., and Sklyarevich, F. A.]

[Text] A recurrent stationary distribution calculation algorithm is proposed for a computer association (mass service system) with a two-dimensional Markov description, which permits computer realization when the space of the states has large dimensions. A general procedure is presented in detail for the functioning in a computer network of a terminal computer with a variable operating mode. An algorithm is given for calculating the stationary probabilities of states and the mean residence time of a requirement in such a system.

UDC 519.857:681.324

DETERMINATION OF AN ALGORITHM FOR PROGRESSING THE FLOW OF TASKS IN A NETWORK

[Abstract of article by Demidov, I. K., and Shchers, A. L.]

[Text] The article investigates one approach to the creation of algorithms and programs for progressing the flow of transactions entering a network of computer centers. An algorithm is proposed which permits determining with minimum expenditures of time whether a transaction belongs to a certain class of messages and placing it accordingly in a computer center or group of computer centers at which problems of the given class can be solved. The algorithm uses a table of solutions with expanded input, for the transformation of which the method of dynamic programming was applied in the solution tree. A table of solutions with four conditions is examined as an example. As a result of its transformation a program is obtained which describes a solution tree with a minimum mean read-out time.

UDC 681.32:519.713

PROCEDURE FOR SYNTHESIS OF ASYNCHRONOUS PROGRAMMED LOGICAL MATRIX AUTOMATA

[Abstract of article by Yakubaytis, E. A., Bul', Ye. S., Lange, E. E., Lemberskiy, I. G., Fritsnovich, G. F., and Chanenko, V. P.]

[Text] The conditions are investigated under which a certain subset of junctions occurring under the effect of different input states (intervals) can be represented by a single member of a DNF system of Boolean functions describing the logical structure of an automaton to be synthesized. Synthesis of the automaton is formulated as a procedure for construction of a DNF system of Boolean functions with a minimum number of different numbers, or close to the minimum. If the constructed DNF system of Boolean functions is realized on a programmed logical matrix (PLM) with prescribed parameters, the task under consideration is considered solved. If the parameters of the constructed DNF system are greater than the PLM parameters, a procedure for automaton synthesis based on several PLM is proposed.

UDC 681.3

ANALYSIS OF THE LOADING OF COLLECTIVE-USE UNIFORM MICROPROCESSOR COMPUTER SYSTEMS

[Abstract of article by Makarevich, O. B, Saak, E. M., and Chefranov, A. G.]

[Text] An analysis is presented of the statistical characteristics of uniform collective-use computer systems in the cyclic distribution of complex problems. On the basis of geometric considerations a distribution of the probabilities of the number of tasks served per cycle is obtained, as is the mathematical expectation of the number of served tasks. On the basis of the obtained characteristics a procedure is proposed for the selection of parameters of the system.

UDC 519.717.7

LOGICAL NETWORKS OF THREE-INPUT OPERATORS

[Abstract of article by Blokh, A. Sh., and Pavlovskiy, A. I.]

]Text] Algorithms are proposed for the synthesis of logical networks on a separate set of three-input operators. Estimates are made of the complexity of synthesis algorithms and obtained logical networks.

UDC 519.713

CONSIDERATION OF THE FUNCTIONAL DEPENDENCE OF CODE SETS IN OPTIMIZING THE TWO-LEVEL LOGICAL STRUCTURE OF AN AUTOMATON

[Abstract of article by Lemberskiy, I. G.]

[Text] The article examines optimization of the disjunctive normal form of a system of functions of automaton junctions and output on the basis of the number of conjunctions with consideration of the functional dependence of the code sets. The conditions are formulated for a code assuring the given optimization. Within the framework of those conditions a heuristic procedure is being worked out to reduce the number of conjunctions. An approach to the construction of a non-redundant code of internal states is proposed.

UDC 519.714

FUNCTIONAL COMPLEXITY OF THRESHOLD STRUCTURES

[Abstract of article by Alakoz, G. M.]

[Text] From a combinatory estimate of the power of a given class of multivalued logical functions a system of canonical transformations is constructed for multithreshold elements, functionally complete with respect to that class, with a multivalued structural alphabet. It is shown that minimally threshold realization of logical functions during reorganization of multithreshold element structural parameters forms a linearly algebraic structure, the power of the classes of which is expressed through the index of the group of canonical transformations and is an additive monotonically increasing function of multithreshold element structural parameters. A connection of the introduced measure of complexity with the Shannon measure and also with other approaches to the theoretical group description of the work of logical elements is noted.

UDC 681.3.06

SOLUTION OF EXTREMUM PROBLEMS UNDER CONDITIONS OF INCOMPLETE INFORMATION

[Abstract of article by Adamenko, G. M.]

[Text] The article considers methods of solving tasks in cases where there is insufficient prior information for the selection of algorithms for their solution. The setting of tasks of successive synthesis of algorithms, leading to questions of parametric and structural adaptation, is pointed out.

UDC 519.7

PROBABILITY CHARACTERISTICS OF PERFORMANCE OF A TIME-REDUNDANT ENGINEERING SYSTEM

[Abstract of article by Mikadze, I. S., and Tavladashvili, V. D.]

[Text] The task is set of determining the probability characteristics of the performance of an engineering system intended for the performance of tasks of a definite volume in a given time and consisting of two series-connected subsystems which are kept self-adjusting and failure-resistant. In that case one of the subsystems is capable of revealing double and correcting single errors, and the second, only of revealing single errors. The process of performing the task of such an engineering system is regarded as semi-Markov with a finite number of states. The distribution function of the task execution time is determined, and its mean value with consideration of reliability and time-redundance of the system under consideration.

UDC 519.853

METHOD OF COORDINATE-WISE DESCENT FOR A CLASS OF INTEGRAL NONLINEAR PROGRAMMING PROBLEMS

[Abstract of article by Mayer, A. B.]

[Text] The author examines an algorithm for solving the task of integral nonlinear program with a monotonically increasing objective function and limitations, given in the form of a nonlinear function of arbitrary type and inequalities limiting the area of change of integral variables. The main algorithm is a modified method of coordinate-wise descent, in which the direction of the next step of the iterative process is determined from the criterion of the minimum ratio of the increments of the limiting and objective functions.

UDC 519.712

SYNTHESIS OF READILY TESTABLE COMBINATIONAL CIRCUITS BY FACTORIZATION OF DEADLOCK DISJUNCTIVE NORMAL FORMS (DNF)

[Abstract of article by Parshina, N. A.]

[Text] An investigation is made of the properties of a class of circuits obtained by factorization of deadlock DNF. An algorithm is proposed for the synthesis of such circuits, which have very short verification tests.

UDC 621.317.755.018.756

NOISE IN A DIFFERENTIAL STROBING CONVERTER

[Abstract of article by Stasha, R. Ya.]

[Text] Expressions are derived for calculating noise on the output of a differential strobing converter. It is shown that the noise level in a differential stroboscopic converter is the same as in a Goto vapor stroboscopic converter. During corresponding execution of the strobe-signal former circuit the noise of its source has no effect on the noise level on the converter output.

UDC 621.317.3

METHOD OF DIGITAL STOCHASTIC CONVERSION OF THE VALUE OF A NONLINEAR DISTORTION FACTOR

[Abstract of article by Mikelson, A. K., and Krauze, A. V.]

[Text] The article examines a method of converting the value of a nonlinear distortion factor intended for the construction of corresponding equipment. It is shown that the application of stochastic quantizing of the second kind to determine the mean signal power and the power of its first harmonic permits solving with apparatus the given task without application of apparatus means of multiplication of multidigit numbers, thus simplifying the apparatus and reducing the measurement time.

UDC 519.856

METHOD OF REDUCING VARIANCE DURING STOCHASTIC QUANTIZATION

[Abstract of article by Veselova, G. P.]

[Text] A method is proposed for selecting interpolating random values which permits reducing the error of stochastic quantization. It is advisable to use the proposed selection in the creation of stochastic analyzers, and also in the organization of statistical analysis using small computers.

[413-2174]

2174
CSO: 1863

ABSTRACTS FROM THE JOURNAL 'TECHNICAL CYBERNETICS'

Moscow IZVESTIYA AKADEMII NAUK SSSR. TEKHNICHESKAYA KIBERNETIKA in Russian No 4, 1980 pp 219-224

UDC 519.3:62-50

OPTIMUM GUARANTEED EVALUATIONS OF UNCERTAINTIES USING ELLIPSOIDS

[Abstract of article by F. L. Chernous'ko]

[Text] A guaranteed approach to the description of uncertainties in control problems is developed which is based on approximation of the fields of uncertainty with ellipsoids. An approximation is constructed of the ellipsoid intersection operation. 2 figures, 13 references.

UDC 53.072:681.31

NUCLEUS OF A SIMULATION SYSTEM (SIMPLIFIED VERSION)

[Abstract of article by Yu. P. Ivanilov]

[Text] A simulation system language is proposed which is constructed on the basis of process description. The language permits structural alteration of the system and the constituent process creating theoretical problems in the computer, the analysis of whose solution determines further simulation and the nature of the solutions adopted. 1 reference.

UDC 007:338.984

PLANNING COMPUTATIONS IN A DIALOGUE LONG-TERM PLANNING SYSTEM

[Abstract of article by P. I. Litvintsev]

[Text] Several requirements imposed on dialogue planning systems oriented toward users with activities which are far from the practical operation of a computer are discussed. One method of automated planning of computations is proposed for the set of information-related programming modules appearing in the dialogue system. 1 figure, 10 references.

UDC 519.8

ON THE PROBLEM OF DESIGNING STABLE BRIDGES IN A DIFFERENTIAL--APPROACH/DEFLECTION GAME

[Abstract of article by V. N. Ushakov]

[Text] A differential game of approach and deflection is considered with geometric constraints on player control. The problem of designing minimax u-stable bridges based on understood procedures is investigated. 10 references.

UDC 681.142.1.01

ASYNCRHONOUS PROCESSES. I. DEFINITION AND INTERPRETATION

[Abstract of article by V. I. Varshavskiy, V. B. Marakhovskiy, V. A. Peschanskiy, L. Ya. Rosenblyum]

[Text] A formalized concept of asynchronous processes is introduced. Within the framework of the proposed model, an interpretation is given of a finite automaton and Petrie networks. This permits interpretation and several other mathematical models of representation of work of discrete devices. A description of the mechanism of resumption of an asynchronous process is formalized. The operation of reduction of asynchronous processes is proposed. It is noted that the models under consideration may be used to describe combined matched operation of discrete devices. 3 figures, 12 references.

UDC 62-50

THEORETICAL BASIS AND ALGORITHM OF THE RELAXATION PROCEDURE FOR PROBLEMS OF A QUASI-CONCAVE PROGRAM

[Abstract of article by G. V. Kalyuzhnyy]

[Text] A theoretical basis and algorithm for the relaxation procedure of problems of quasi-concave programming are given. A modification is proposed for the relaxation procedure for problems of concave programming which increases its effectiveness. The convergence of the procedure is proven. Several examples are given. 4 figures, 6 references.

UDC 62-50:531.3

SIMULATION AND SYNTHESIS OF MANIPULATOR CONTROL FOR MECHANICAL ASSEMBLY

[Abstract of article by M. Vukobratovich, D. Stokich]

[Text] The problem of simulating and synthesizing manipulator control for assembly of components and parts of a mechanism is considered. Particular attention is given to detailed analysis of the dynamics of the ensemble:

manipulator-working object; external forces acting in the assembly process are considered. Results of simulation of assembly operations are presented in which a part is inserted into a hole (shaft-aperture); the simulation took into account forces occurring upon contact of part of the assembly. Various cases are considered: both with and without feedback in terms of these forces. 8 figures, 12 references.

UDC 62-50:531.3

ON EFFECTIVE ORGANIZATION OF THE COMPUTING PROCESS IN SOLVING PROBLEMS OF MECHANICS AS APPLIED TO MANIPULATION ROBOTS

[Abstract of article by F. M. Kulakov, T. N. Smirnova]

[Text] A method is proposed for basic acceleration of computations (several orders faster than known methods) in solving direct and inverse problems of mechanics as applied to robot manipulators with various kinematic circuits. This is achieved by block concretization of algorithms and effective organization of information, which reduces the amount of computations to a significant extent and makes it possible to broadly deparallelize the computing process. 3 figures, 6 tables, 2 references.

UDC 62-50:531.3

CONTROL STRUCTURE ALGORITHM OF A TRANSPORT ROBOT

[Abstract of article by A. V. Kalyayev, V. P. Noskov, Yu. V. Chernukhin]

[Text] An algorithm is considered for plotting the course of movement of an adaptive transport robot suited for realization in a uniform, neuron-like control structure which implements parallel input of sensory information, its parallel processing and parallel output of control signals to the effector system. Questions of formalization of the description of the environment and questions of synthesizing the control structure are investigated. Data are presented on an operational mock-up of an adaptive transport robot which realizes the proposed algorithm. 7 figures, 6 references.

UDC 007:681.327.12

COMPUTER SIMULATION OF AN INTEGRATED ROBOT WHICH PACKS PARTS ACCORDING TO AN OUTLINE

[Abstract of article by D. Ye. Okhotsimskiy, Ye. Yu. Zuyeva, M. M. Komarov, S. A. Mirer, Yu. A. Sadov, V. A. Sarychev]

[Text] The structure and operation of a complex of programs permitting computer simulation of the activities of an integrated robot manipulator in a three-dimensional medium consisting of polyhedrons are described. The composition of this complex includes programs to simulate the environment and to simulate methods of robot interaction with it and programs which realize

algorithms of robot-reprocessing of information in the perception, planning of actions and design of movements. The system permits us to simulate the robot's decision-making proces for the problem of packing polyhedral parts into a structure assigned by a tnree-projection outline. Movements of the manipulator may be depicted on a display screen and recorded on movie film. 3 figures; 18 references.

UDC 62-50

SIMULATION OF ANTHROPOMORPHIC CONTROL OF THE TRANSPOSITION PHASE OF THE LEG OF A REHABILITATION EXOSKELETON

[Abstract of article by V. A. Bodganov, V. S. Gurfinkel', V. G. Ostapchuk]

[Text] The model of the leg of a simplified exoskeleton for patients with limp paralysis of the lower extremities is described, including flexible connections which make the movememts of the model similar to the transposition motion in a normal person, a special pulsed drive with flexible accumulator of mechanical energy stored from a comparatively low-output electric motor, and an electronic control system for the finite states of the transportation movement. Results of simulation show that motion of the simplified exoskeleton, like human movements, are smooth and stable. The simulation results may be used in designing a real exoskeleton. 3 figures; 1 table; 13 references.

UDC 519.217

DETERMINATION OF THE CHARACTERISTICS OF THE FLOW OF EVENTS GENERATED BY A PIECEWISE-CONTINOUS MARKOV PROCESS

[Abstract of article by V. A. Ivnitskiy]

[Text] The piecewise-continuous Markov process with fields of values of continuous variables having the form (0, a) where a is less than or equal to infinity is considered. The mean time of residence in the permissible set of states A and the intensity of flow of moments of its emergence from A are defined. Simila- characteristics are defined for a one-dimensional random process which is a function, acquiring actual values, of this process. 16 references.

UDC 519.217

ON A UNILINEAR QUEUEING SYSTEM BASED ON SELECTION TIME

[Abstract of article by V. V. Marbukh]

[Text] A unilinear queueing system without losses having N incoming Poissonian requirement flows in the presence of selection time is considered. For the queueing discipline "stochastic priorities with forced downtime of the servicing instrument" algorithms are indicated for precise and approximate computation of the functional: average losses from residence of the requirement in the system.

In some region of parameters the introduction of forced downtime of the servicing device lowers the value of the functional as compared to the cyclical discipline with total elimination of sequence. 7 references.

UDC 519.2

FIDUCIAL APPROACH TO ASSESSMENT OF THE CHARACTERISTICS OF COMPLEX SYSTEMS BY THE RESULTS OF TESTING

[Abstract of article by I. V. Pavlov]

[Text] An approximate method of plotting the confidence limits is considered for the characteristics of complex systems by the results of reliaibiltiy tests which is based on Fisher's fiducial approach. Based on a comparison of fiducial and confidence limits, a connection is established between fiducial and unbiased confidence limits. 1 figure; 12 references.

UDC 519.2

FIDUCIAL APPROACH IN INTERVAL EVALUATION OF THE RELIABILITY OF COMPLEX SYSTEMS

[Abstract of article by L. B. Groysberg]

[Text] Structurally redundant systems, including recoverable ones, with a cyclic mode of application are considered, for which the model of reliability in the general case does not reduce to a series-parallel connection; the relationship of the reliability indicator of the system as a function of the reliability parameters of components can not have an analytical expression. The problem is posed of interval evaluation of the reliability indicator of the system according to testing data of equipment components based on the fiducial approach which enables us to reduce the problem to the discovery of the functional distribution versus random independent variables having known distributions of probability. The solution is achieved based on the use of the method of statistical computer simulation with equivalent transformation of the model. Relationships are given for determining unbiased estimates of moment and quantile parameters of the fiducial distribution of the reliability indicator. Results are shown for the computer experiment done using the proposed methods for one of the systems. Relationships between fiducial and confidence intervals are considered. 1 figure; 11 references.

UDC 519.2

DETERMINATION OF THE DISTRIBUTIVE FUNCTIONS OF TROUBLE-FREE OPERATION OF ELEMENTS ACCORDING TO OBSERVATIONS OF THEIR WORK AS A PART OF SEQUENTIAL SYSTEMS

[Abstract of article by G. V. Kolosok, Ye. I. Ushakov]

[Text] The distributive function of trouble-free operation time of elements can not be directly defined according to results of observation of their work as a part of sequential non-recoverable systems. A solution of the above problem is proposed for independent elements. 1 figure.

UDC 519.2

PLANNING RENOVATION WORK BASED ON SHIFTING OF EQUIPMENT

[Abstract of article by V. F. Kuznetsov]

[Text] The problem of distribution of equipment for conduct of renovation work based on the possibility of their movement and repeated utilization is considered. A general method of tackling the problem is proposed for the criteria formulated. 1 figure, 8 references.

UDC 519.2

SEVERAL PROPERTIES OF THE DEFICIT FUNCTION FOR A PERIODIC MODEL OF SPARE PARTS CONTROL

[Abstract of article by B. I. Shustov]

[Text] A supply system is examined in a finite segment with periodic monitoring including a central warehouse and n downstream warehouses with normally distributed demand. Estimates of system deficit and some of its properties in quasi-real strategies are cited. 2 figures; 1 reference.

UDC 007.52:517.11:519.5

SYNTHESIS OF AN AUTOMATON WHICH CONTROLS THE PROPER OPERATION OF A DISCRETE DEVICE

[Abstract of article by I. M. Fomenko]

[Text] An algorithm for synthesis of a control automaton is proposed that is based on the presentation of a schedule of automaton movements as a language grammar having a finite number of states. The synthesized automaton makes it possible to control the proper operation of a desired discrete device when it is used for its purpose. An example which illustrates the use of the proposed algorithm is cited. 3 figures; 3 references.

UDC 62-50

INVERSE PROBLEMS OF DYNAMICS OF CONTROLLED SYSTEMS. LINEAR MODELS.

[Abstract of article by B. N. Petrov, P. D. Krut'ko]

[Text] Procedures are developed for constructing alogorithms for control of movements based on the solution of inverse problems of dynamics. It is shown that this approach makes it possible to synthesize systems with desired dynamic properties. The required controls are determined in closed form: parameters of the laws of control are expressed as finite relationships by parameters of mathematical models of controlled systems. 3 figures; 13 references.

UDC 62-50:519.3

SYNTHESIS OF CONTROL SYSTEMS FOR ONE CLASS OF NONLINEAR OBJECTS WITH DELAY

[Abstract of article by V. I. Lovchakov, A. A. Fomichev]

[Text] The problem of optimum control of one class of nonlinear objects with delay is considered. In analytical form, an optimum law of control is obtained in the form of feedback, described with the aid of Voltaire's functional series. An algorithm is proposed for approximate realization of the optimum feedback law. 1 figure; 23 references.

UDC 519.283

THE BRANCHING AND BOUNDARIES METHOD IN THE PROBLEM OF RECOVERY OF FUNCTIONS ACCORDING TO THEIR DISCRETE REFERENCES

[Abstract of article by V. K. Klochko, Ye. P. Churakov]

[Text] The problem of specifying functions from a set of ambiguously related measurement results is solved. Algorithms based on the branching and boundary method are elaborated and experimental investigated. 3 figures; 2 tables; 7 references.

UDC 62-50

ON SEQUENTIAL IDENTIFICATION OF STOCHASTIC SYSTEMS

[Abstract of article by S. E. Vorobeychikov, V. V. Konev]

[Text] Clear formulas are constructed for sequential estimates of parameters of processes having discrete and continuous time. The effect on the quality of evaluation of linear constraints on the parameter is studied. The presentation is illustrated with numerical examples. 2 tables; 10 references.

UDC 62-50

ON THE RELATIONSHIP BETWEEN THE RATE OF CONVERGENCE OF THE IDENTIFCIATION PROCESS AND THE SENSITIVITY OF THE SYSTEM TO INITIAL DATA ERRORS

[Abstract of article by Yu. M.-L. Kostyukovskiy, A. I. Nefelov]

[Text] A quantitative estimate is constructed for characterization of the sensitivity of the output of a nonlinear controlled system to infinitesimal relative perturbations of coordinates of the initial state of this system. It is shown that the estimate can serve as an indicator of the rate of convergence of the procedure of parametric identification. 8 figures; 4 references.

UDC 62-50

ON ESTIMATING THE COMPLEXITY OF A DIALOG PROCEDURE OF DISTRIBUTION OF RESOURCES

[Abstract of article by V. I. Yakobashvili]

[Text] Questions of constructing a dialogue procedure for sampling projects based on the constraint of resources are considered. A specific version of the procedure is proposed and an estimate of the number of paired comparisons is obtained which should be made by the LPR. 1 figure; 1 table; 5 references.

UDC 519.152

ON THE METHOD OF SOLVING ONE EXTREMAL PROBLEM IN QUEUEING THEORY

[Abstract of article by V. V. Kozlov, A. V. Krachenko, V. A. Krasavkina, V. V. Filippov]

[Text] A queueing system with n servicing instruments is considered into which enters a Poissonian flow of requirements with intensity lambda. There is an unlimited number of second type requirements. An algorithm is elaborated and the program is written for this system. 3 references.

UDC 519.217

RELIABILITY OF RECOVERABLE RESERVE SYSTEMS UNDER CHANGING CONDITIONS OF EXPLOITATION

[Abstract of article by Ya. G. Genis]

[Text] An estimate is obtained for the instantaneous parameter of flow of system breakdowns, whose operation between breakdown of its components is described by a nonstationary Poissonian process with an instantaneous parameter which is a function of time and some random parameter. Based on this estimate, simple formulas are obtained for calculating system reliability with structural and time reservation of various kinds. Calculation is cited of system reliability for 24-hour three-shift work in which restoration of broken-down elements in one shift (e.g., night) is not foreseen. 3 references.

UDC 519.24:531.3

RESTORATION OF BLURRED IMAGES WITH IMPRECISELY KNOWN RATE OF MOTION OF THE RECORDING EQUIPMENT

[Abstract of article by R. D. Baglay]

[Text] The nature of distortions occurring in numerical restoration of blurred images is studied where the blurring parameter is approximately known. Methods are indicated which make it possible to find the true value of the blurring parameter in the numerical experiment of images of a rather general kind. Examples are cited for computer restoration of blurred images. 3 figures; 2 references.

[17-8617]

8617
CSO: 1863

END