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CYBERNETICS, COMPUTERS AND AUTOMATION TECHNOLOGY

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USSR REPORT

CYBERNETICS, COMPUTERS AND AUTOMATION TECHNOLOGY

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HARDWARE

UDC 681.3:681.518.3

APPLICATION OF MICROPROCESSORS IN INFORMATION-MEASURING SYSTEMS AND INFORMATION AND COMPUTING PACKAGES

Leningrad SOSTOYANIYE ELEKTROIZMERITEL'NYKH PRIBOROV I SISTEM NA OSNOVE SREDSTV VYCHISLITEL'NOY TEKHNIKI (MIKROPROTSESSOROV I MINI-EVM) [State of Electrical-Measuring Instruments and Systems Based on Means of Computer Technology (Microprocessors and Minicomputers)] in Russian 1979 pp 32-42

ANDREYEVA, I. A., PAVLENKO, A. N. and CHEBLOKOV, I. V.

[From REFERATIVNYY ZHURNAL. METROLOGIYA I IZMERITEL'NAYA TEKHNIKA No 2, 1980 Abstract No 2.32.54]

[Text] Aspects of the effect of microprocessors on the development of information-measuring systems are considered. Two variants of microprocessor devices designed on the basis of the Soviet K580 microprocessor are described. The first device is represented by a general and most typical variant of the microprocessor system, while the second is represented by an elementary data collection system consisting of a commutator, an analog-to-digital converter, and a microprocessor. Figures 3.
[222-1386]

UDC 778.38

HOLOGRAPHY IN INFORMATION SCIENCE ACTIVITY (STATE AND PROSPECTS)

Moscow TEORIYA I PRAKTIKA NAUCHNO-TEKHNICHESKOY INFORMATSII [Theory and Practice of Scientific-Technical Information] in Russian 1979 pp 122-123

SHCHUKA, A. A.

[From REFERATIVNYY ZHURNAL. INFORMATIKA No 2, 1980 Abstract No 2 I245 by V. L.]

[Text] Coherent methods for information storage display marked advantages over their optical counterparts owing to the technological nature of the adjustment of optical systems, the high reliability and rapid readout date of information, and the possibility of storing both digital and analog information in the same device or combining the functions of storage and logic in the memory.

The advantages of coherent methods are: simplicity of duplication of holograms, possibility of obtaining a magnified or reduced image, recording of three-dimensional images, absence of optics in image reconstruction. The possibility of using holographic information processing systems in AIPS [Automated information retrieval system] document reproducing devices, and equipment for the dissemination of scientific and technical information is considered. References 7.
[222-1386]

UDC 681.327.07

ERROR DETECTING TESTS FOR LSI ADDRESS DECODER

Riga TSIFROVYYE USTROYSTVA I MIKROPROTSESSORY in Russian No 3, 1979 pp 153-163

GAVRILOV, A. A. and GAVRILOV, V. A.

[From REFERATIVNYY ZHURNAL. AVTOMATIKA, TELEMEKHANIKA I VYCHISLITEL'NAYA TEKHNIKA No 1, 1980 Abstract No 1 B235]

[Text] Test sequences for detecting errors in the structure of the BIS OZU [large-scale integrated microcircuit main storage unit] of the address decoder are presented, as are the findings of an analysis of known and new tests with respect to their ability to detect constant errors of address decoders. Figures 4; tables 1; references 4.
[212-1386]

AUTOMATION OF DESIGN IN MICROELECTRONICS--THEORY, METHODS AND ALGORITHMS

Novosibirsk AVTOMATIZATSIYA PROYEKTIROVANIYAV MIKROELEKTRONIKA-TEORIYA, ALGORITMY in Russian 1978 signed to press 30 Nov 78 pp 2, 114-117

[Excerpts from collection "Computing Systems, 77," Scientific Editor, Candidate of Technical Sciences V. A. Skorobogatov, Institute of Mathematics, Siberian Department of USSR Academy of Sciences, 800 copies, 118 pages]

[2]

The editorial board consists of V. L. Dyatlov, E. V. Yevreinov, Yu. S. Zav'yalov, N. G. Zagoruyko, Yu. G. Kosarev (editor in chief), V. A. Skorobogatov and V. G. Khoroshevskiy.

ANNOTATION

Theoretical and methodological problems of automation of design and microelectronics are considered in the articles of the collection.

The first section of the collection is represented by six theoretical papers in which problems arising in developing effective algorithms of graphs are discussed. These are analysis of the properties of graphs and hypergraphs by means of their Fourier transforms, characterization of isometric graphs by means of layer matrices, study of new algorithms of searching for features, representation of graphs, properties of module composition and the effectiveness of random search algorithms is also studied.

The second group includes two papers which investigate theoretical problems of programming.

The third section is represented by papers devoted to logic design of programmed logic matrices, modeling of geometric design which describes the topology of LSI and also modeling and calculation of integrated systems.

The materials of the collection are intended for specialists in the field of programming and automation of design and development of SAPR (automated design system) and also for specialists on algorithms and applications of graph theory.

UDC 519.1

Analysis of the Properties of Hypergraphs and Graphs by Their Fourier Transforms, O. L. Bandman and V. P. Markova.

It is known that the apparatus of harmonic analysis can be used to study the properties of any complex function determined in an infinite Abelian group. Based on the isomorphism between hypergraphs and Boolean functions, an attempt is made in the article to investigate the properties of the Fourier transforms of hypergraphs and graphs as a special case of them. The relationship between Fourier coefficients for hypergraphs and graphs of some classes are found on the basis of known propositions of harmonic analysis. References 4, figures 5, tables 1.

UDC 517.17

Layer Matrices and the Isometric Nature of Graphs, V. A. Skorobogatov.

Isometric graphs and some of their properties are considered in the paper of H. Chartrand and J. Stewart (REFERATIVNIY ZHURNAL KIBERNETIKA, 12B586, 1971). Characterization of isometric graphs which were considered by the author previously (see "Voprosy obrabotki informatsii pri proyektirovanii sistem " [Problems of Information Processing in Systems Design] (VYCHISLITEL'NYYE SISTEMY, No 69), Novosibirsk, 1977) is given in the present paper. It is shown that coincidence of one-spectra of two neographs is a necessary and sufficient condition of their isometric nature. In this case a one-spectrum is understood as part of a layer matrix consisting of all different lines in pairs. References 3, figures 2.

UDC 519.17

Using Relative Division for Finding Cliques, Yu. Ye. Bessonov and V. A. Skorobogatov.

Three clique-finding algorithms based on relative divisions of the graph into layers are proposed. According to the definition, the vertex u is found in the i-th layer with respect to vertex v if the distance from u to v is equal to i. It is shown that the time of completing the algorithm for finding all cliques in a graph with p vertices has an order of $0(p^2(1.62)p)$ in the worst case and the storage capacity may increase as $0(p^2)$. The dependence of the calculating complexity on some characteristics of the graph are found. Data of experimental investigation of the time of completing the algorithms on random graphs are presented. References 6, figures 4.

UDC 519.1

Representation of Neographs by Linear Formulas, Yu. Ye. Bessonov.

Linear formulas (K-formulas) first introduced by A. T. Berztiss (REFERATIVNIY ZHURNAL MATEMATIKA, 9B743, 1974) for representation of orgraphs are distinguished by high compactness of notation. Similar methods of finding the minimum set of K-formulas of nonoriented graphs and also the nonrecursive algorithms which restore the neograph by its K-formula representation, which is a modification of C. Bays algorithms (REFERATIVNIY ZHURNAL MATEMATIKA, 6V438, 1977), are proposed in the article.

UDC 519.1

Some Numerical Characteristics of Module Composition of Graphs, A. A. Timofeyev.

The chromatic number, the chromatic class and the nondensity of the module composition are considered in the paper. The chromatic number has estimates expressed by a visible set of characteristics of initial graphs and their supplements. The chromatic class is expressed by chromatic classes of initial graphs and their supplements and the chromatic class of a complete n-vertex graph. A set of conditions is presented in which nondensity of the module composition assumes a maximum value. References.

UDC 519.95

Random Search for an Optimum System of Features, V. G. Ustyuzhaninov.

Problems of the effectiveness of algorithms which carry out random search for an optimum system of features are considered in the paper. References 7, figures 1.

UDC 681.142.2

The SMAPS System for Structural Programming in Assembler Language of the OS YeS EVM, Arthur A. Krepskiy.

The paper contains description of SMAPS language (A System of Macros and Procedures for Structured Programming), which is realized by means of macroassembler language of OS YeS [Operating system of the unified system] and is designed to facilitate structural programming in the assembler language of OS YeS EVM [Operating system of the unified computer system]. References 4.

UDC 519.688

Constructing the Generalized Storage of a R-Machine for Text Information Processing Problems, Yu. G. Kosarev and N. A. Chuzhanova.

The possibility of organizing information processing based on construction of a generalized memory of a R-machine is considered, a set of operations is carried out and the properties of the data structures which determine

the permissible set of operations and the method of memory description are analyzed. References 8, figures 2, tables 2.

UDC 681.3.001

The Theoretical-Structural Method of Encoding Microinstructions, S. M. Achasova.

The article is devoted to one of the problems of logic design of programmed logic matrices, namely to the problem of encoding the information of the first level of these matrices. Based on the theoretical-structural properties of the binary code, properties of encoding and conversion of a system of Boolean functions are formulated as a unified problem of designing programmed logic matrices. A simple heuristic encoding algorithm which utilizes the compact representation of algebraic structure is proposed. References 5.

UDC 621.382.32

A Model of Geometric Design, V. G. Khrushchev.

A model of geometric design of integrated circuits not containing the principle limitations on the shape of the topological components of the integrated circuits is considered for the case when the topology is initially described by a set of boundary circuits of these components. The main parameters of the described model include the characteristic of the relative mutual position of the components of the geometric design and consideration of the restrictions on the dimensions of the components and the distance between them. Operations which serve for calculating these parameters are considered. Formulas which permit realization of these operations in practical applications are presented for the special case. References 4, figures 4.

UDC 519.682.6

Comparative Analysis of the Basic Languages of Discrete Modelling, N. I. Dubovskaya.

Analysis of discrete modelling languages, which has become widely used when investigating complex systems, is presented in the article. The requirements placed on the modelling languages are outlined and classification of languages by the method of describing the dynamics of functioning of the system is presented. Languages which have become most widely used--CSL, SIMSKRIPT, GPSS, SOL and SIMULA--are considered in this case. Their characteristic features, advantages and disadvantages are determined. Special attention is devoted to SIMULA language, which is a rather powerful tool for modelling processes which occur in parallel and which interact with each other. The main principles of constructing the universal SIMULA-67 programming language, whose main property is the possibility

of orientation to special classes of problems and which is a very interesting attempt to solve the problem of creating a unified standardized programming language, are also considered. References 8, figures 2, tables 1.

UDC 681.3.06

A Program for Block Modelling of Transient Processes in MDP IS by Means of Computers of Type YeS, N. I. Hazarov.

A program for block modelling of MDP IS with complexity up to 250 transistors by using computers of type YeS is considered. The class of investigated circuits, the nature of the input information, the capabilities and restrictions are described. References 1, figures 1.

UDC 621.382

Minimization of Delay in a Circuit of Stage-Connected Logic Components of the MDP of Integrated Circuits, N. I. Nazarov.

It is suggested that previously established rules for modification of channel widths in each of the components be used when minimizing the delay in a circuit with restriction on the sum of widths of the transistor channels. The rules are established from the results of optimizing the components or from experiment. References 2, figures 2.
[274-6521]

6521
CSO: 1863

PROBLEMS OF THE THEORY AND CONSTRUCTION OF COMPUTER SYSTEMS

Novosibirsk VYCHISLITEL'NYYE SISTEMY in Russian No 73, 1978 signed to press 3/up-1978, pp 2, 25, 37-39, 168-171

[Excerpts from the collection "Vychislitel'nyye sistemy," Institute of Mathematics of the Siberian Department of the USSR Academy of Sciences, 800 copies, 172 pages]

[2]

ANNOTATION

The collection contains papers devoted to the theory and methods of constructing homogeneous computing systems (VS).

The problems and subject of parallel microprogramming and determined. Realization of parallel microprograms in homogeneous microprocessor systems is described. A method is proposed for checking parallel microprograms for determinants and also for accomplishing control on the basis of associative sampling and entry of microprograms into programmed logic matrices.

The results of investigating the macrostructure of homogeneous VS are presented. Problems of self-diagnosis of homogeneous systems and the reliability of distributed VS are considered. Problems of software are represented by debugging of parallel programs for MINIMAKS calculating systems, by algorithms for deparallelling cycles of files and by estimates of the time required for operators to achieve parallel programs.

The materials of the collection are of interest to specialists in the field of calculating systems and parallel processing structures.

[25] S. N. Sergeyev, Realization of Parallel Substitution on Algorithms in Microprocessor Systems

The problem of using parallel substitution algorithms for organizing mass calculations in parallel microprocessor systems is considered in the paper.

Operational intermodule interactions in these systems are one of the serious problems which do not at present have a satisfactory solution. The reason for this, we feel, is two circumstances: first, the relative newness of the problem (the first communications on development of large homogeneous calculating systems based on microprocessors appeared in 1975 [1]) and second, the fact that attempts are usually made in solving this problem to transfer traditional methods of intermachine interactions developed for calculating systems based on large, medium or mini-machines which require sufficiently developed operational systems for their own realization, to microprocessor systems, which is not always possible for microprocessor systems.

The closest model to this type of calculating structure is the cage automaton--a uniform aggregate of elementary automatons (cages) connected in an identical manner to each other and functioning identically. An important feature of the cage automaton is the locality of information processing: each automaton exchanges and processes information obtained from a small number of adjacent automatons. Using the cage automaton as a model of the class of structures of interest, we should also select the appropriate algorithm for describing the behavior of the cage automaton. Algorithms of parallel substitutions are used for this purpose in the given paper [2].

[37-39]

Conclusions

The problem of using parallel substitution algorithms for organization of intermachine interactions in microprocessor systems is considered in the article. A class of functional substitutions which permits more complete use of the functional capabilities of microprocessors is introduced.

The examples considered in the article permit one to conclude that the use of the substitution operator is the simplest microoperator for organization of mass calculations at the microlevel permits on the one hand rather easy and compact notation of algorithms and on the other hand does not require construction of a complex interpretation system.

These advantages of parallel substitutions could be manifested even more fully if the microprocessor structure permitted direct interpretation of substitution as a microoperation. As can be noted, the functional capabilities of the microprocessor are used only in completing the right side of the substitution in the given substitution operator microprograms and the left side is interpreted with time losses; therefore, introduction of the operation of comparing two codes with development of the comparison feature later used to control the information inputs of the microprocessor to the microprocessor logic will permit significant simplification of the microprograms for realization of the substitution operator.

Some requirements on the structural and logic characteristics of microprocessors for more effective realization of substitutions can be derived from the considered examples of substitution microprograms.

1. The greatest possible number of external poles. So-called "bit-slice" microprocessor sets are the best to be adapted in this regard for realization of substitutions [5]. They have the capability of increasing the digit capacity and this property of them can be used to increase the environment.

2. The microinstruction system should include microinstructions for comparison of two codes.

3. The central processor element should contain the greatest possible number of internal registers. This permits more rapid realization of substitution.

4. Intel-3000 and SBPO 400 more fully meet these requirements among the known microprocessor series.

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3. Bandman, O. L., S. V. Piskunov and S. N. Sergeyev, "Problems of Parallel Microprogramming," See the Present Collection.

4. Kornev, Yu. N., S. V. Piskunov and S. N. Sergeyev, "Algorithms for Generalized Substitutions and Problems of Interpreting Them," TEKHNICHESKAYA KIBERNETIKA, TRUDY SEMINARA, No 4, Kiev, 1970.

5. Makarevich, O. B., B. G. Spiridonov and P. P. Kravchenko, "Micro-Computers as a Means of Information Processing, A Survey," ZARUBEZHNAYA ELEKTRONNAYA TEKHNIKA, No 9, 1977.

6. Sergeyev, S. N., "A Homogeneous Processor for Signal Processing," in "Voprosy teorii i postroyeniya vychislitel'nykh sistem" [Problems of the Theory and Construction of Calculating Systems] (VYCHISLITEL'NYYE SISTEMY, No 70), Novosibirsk, 1977.

7. Khvostantsev, M. A., "Microprocessors and Data Processing Systems," ZARUBEZHNAYA RADIOELEKTRONIKA, No 9, 1975.

Manuscript received 8 February 1978.

[168-171]

ABSTRACTS

UDC 681.322.0:681.3.06

Problems of Parallel Microprogramming, O. L. Bandman, S. V. Piskunov and S. N. Sergeyev.

The subject and problems of parallel microprogramming which have arisen as generalization of traditional (sequential) microprogramming for the case of homogeneous structures of parallel information processing, are considered in the article. Definitions of the main concepts and descriptions of the formal models are given and the problems which arise in synthesis of parallel (asynchronous) microprograms are enumerated. References 21, figures 11.

UDC 681.322.01

Determination of Parallel Graph-Schemes, P. A. Anishev.

Solution of the problem of checking a system of asynchronous-interacting processes for determinants, given in the form of a parallel graph-scheme of algorithms, is proposed. This check is carried out by analyzing the model of behavior of a parallel graph-scheme (the Petri network) for liveliness and safety. The rules of converting from a parallel graph-scheme to the Petri network are determined and it is shown that the property of liveliness and safety of the corresponding Petri network is a sufficient condition of the determinants of a parallel graph-scheme. An algorithm of checking for liveliness and safety, based on the theorems previously proved in Khak's papers, is presented. The complexity of this algorithm is analyzed. References 6, tables 4, figures 9.

UDC 681.325.5

Graph-Program Control Based on Associative Sampling of Instructions and Data, T. Ts. K"nchev and K. L. Boyanov.

The principles of graph-program control are considered in the paper. The use of memories with associative access is suggested. The general block-diagram of a processor with associative sampling of instructions and intermediate results has been worked out on the basis of the abstract model of parallel processing. An algorithm of the operation of the control device is given. References 12, figures 4.

UDC 681.3.001

Conversion of Microprograms When They Are Entered in Programmed Logic Matrices, S. M. Achasova.

An heuristic algorithm for conversion of microprograms for reduction to compact form for subsequent entry of them in programmed logic matrices is

proposed in the article. The main algorithm is the algebra of divisions on a set of binary sets and theoretical-structural representation of an ordered set of divisions. Modifications of the algorithm are presented and they are compared to the known methods of compression of logic conditions. References 6, figures 3.

UDC 517

Logic Synthesis By Means of Fourier Transforms of Boolean Functions, V. P. Markova.

The possibility of using the apparatus of harmonic analysis in finite Abelian groups in synthesis of Boolean functions is shown. Theorems are proved, on the basis of which the algorithm for reducing the d.n.f. of the Boolean function to simplified form is worked out. The algorithm is realized on the Minsk-32 computer. References 5.

UDC 681.323

Graphs of Intermachine Couplings of Homogeneous Calculating Systems, V. V. Korneyev and O. G. Monakhov.

The minimum diameter and average diameter, which represents the maximum required and averaged distance between pairs of vertices, are selected in the paper as the criterion of optimality of a graph of intermachine couplings. Introduction of the value of engagement g as a parameter in the proposed set of graphs permits determination of the quasi-optimum structures of OVS [Homogeneous computing systems] which permit variation of the number of machines in the system without fundamental breaking of the existing intermachine couplings. References 18, figures 2.

UDC 681.32.001.4

Self-Diagnosis of Systems of Blocks of the Same Type, Yu. K. Dimitriyev.

Systems of blocks of the same type, capable of automatically determining malfunctioning blocks on the basis of analyzing the results of their mutual check if the number of these blocks does not exceed a given value t, are considered in the article. The effect of the macrostructure and the structure of the couplings of a set of blocks which form the diagnostic nucleus of the system on the diagnostic capabilities of the system is investigated. References 7, figures 3.

UDC 681.142.2:681.142.1.01

Some Problems of the Reliability of Distributed Calculating Systems, Yu. M. Volkov.

The functioning of distributed calculating systems (VS) is studied with regard to the possible failures of components. It is suggested that the

system be organized by the type of long-lived or structural-excess functions to provide highly reliable calculations. Criteria for analyzing the reliability of these systems are introduced. The results of investigating the properties of long-lived and structural-excess distributed VS are presented. References 11, figures 5.

UDC 681.142.2

Debugging Programs of Parallel Programs for the MINIMAKS Homogeneous Calculating System, Yu. I. Kolosova.

The dialogue debugging programs designed to control debugging of parallel programs are described. The languages of the control directives and the languages of responses given to the user are considered. The debugging programs were realized on the M-6000 minicomputer, which is the elementary machine for the MINIMAKS OVS. References 7.

UDC 518.5.681.3

Algorithms for Deparallelling a System of Cycles on Files, R. M. Nuriyev.

The criteria for finding the information relationships between iterations of cycles are given. A general algorithm for deparallelling cycles in the presence of a function indicating the relationship of iterations is constructed; the unresolvability of the problem of finding these functions for the general class of program schemes is noted. A simple criterion of parallel fulfillment of a system of cycles of ALGOL-like programs is given. An example of a difference scheme which shows that the significant information independence of iterations does not always result in the possibility of parallel realization is presented. References 5, figures 2.

UDC 519.1:519.2:62-529

Estimating the Time of Operators Achieving a Program, V. I. Znak.

The problem of analyzing the structure of branches of a p-program is considered for determining such characteristics as the probability distribution and estimate of the time of achieving given operators. The operator scheme of the p-branch, by which a set of simple (elementary) paths of the starting operator to a given operator and a set of simple cycles were compiled, is used as the object of the investigation. A procedure is worked out which permits one to find the required characteristics through the laboriousness and frequency of realization of simple cycles. The proposed method of analyzing the schemes was used to analyze the p-branch of a program for solving a system of equations, specifically, to find the time characteristics which determine achievement of a given system-conditional conversion provided that the branch is started from an initial operator. The main possibilities of constructing sets of given operators for modelling the interactions of the branches of the p-program during realization of it are considered. References 8, figures 1.

[270-6521]

6521
CSO: 1863

AUTOMATED DESIGN OF DIGITAL EQUIPMENT

Leningrad AVTOMATIZATSIYA PROYEKTIROVANIYA TSIFROVYKH USTROYSTV in Russian 1979, pp 2-4, 248-249, 253, 254, 259-261

[Annotation, Excerpts, References and Contents from book by Samariy Iosifovich Baranov, Sergey Aleksandrovich, Mayorov, Yuriy Petrovich Sakharov and Viktor Abramovich Selyutin, Leningrad: Sudostroyeniye 1979, 3,700 copies, 254 pages]

[Text] This book presents a number of methods and algorithms, comprising the basis for a system for the automated design of digital equipment, in a form accessible to engineers and developers. The book covers all the practical stages in the design of digital equipment: development of logical circuits, modeling of the circuits on a computer, the development of tests and construction. Attention is focussed on methods suited to engineering applications and leading to the design of systems of realistic complexity. A number of new trends in automated design of digital equipment are reflected.

The book is intended for a wide range of developers of equipment in digital automatics and computer technology, and also for students and graduate students in appropriate fields.

PREFACE

[Text] The rate of technological progress is a decisive factor in the development of all sectors of the national economy. However, in recent years, there has been a tendency for an increase in the length of time involved in the development of new products, in spite of the uninterrupted growth in the number of staff members in design-construction organizations. The principle reason for the increase in time to develop new products is, evidently, the lack of correspondence between their complexity and outmoded methods of design. Under modern conditions an increase in the quality of developments and decrease in design time can be accomplished only on the basis of widely used mathematical methods and computer technology, i.e. with a shift to automated design.

Automated design is especially effective in cases where a shift takes place from separate engineering calculations to the creation of systems of automated design in which all stages of design, construction and technological preparation of production are coordinated. This applies first of all, to

the development of devices in digital automatics and computer technology. The complexity of the structure of these devices is constantly growing. At the same time, demands for the reliability of such devices, their operating speed and development time are becoming more and more stringent. It is obvious that intuitive methods of design, can no longer fulfill these demands.

The development of a system of automated design is extremely important in relation to the organization in our country of large scientific-industrial associations. These associations foster the conditions for the development of complex interrelated systems of automation of scientific experiments, automated design and technological preparation for production, testing and production control of complex products. For transition to automated design, it is essential to implement development and adoption of progressive methods of design, mathematical models, calculation algorithms and appropriate software.

At present a wide range of automated design systems are used, which are focussed not only on individual design problems but on solution of these problems as a complex whole. The number of papers and books devoted to problems of automated design has grown substantially. However, the existing literature, as a rule, is directed to highly trained specialists in the field of automation of design or elucidates problems and methods of automation of separate stages of design. For this reason, in writing this book, the authors set themselves the task of presenting the complex picture of the basic ideas and methods of the automated design of digital equipment in a form accessible to a wide audience. In this attempt, the authors tried to reflect new methods, used in this field as well as those which had not been adequately explained previously. The book basically touches on the algorithmic basis of automation of design and almost fails to consider questions in the organization of systems of automated design.

The first chapter of the book was written by S. A. Mayorov and illuminates the goals and tasks of the automated design of digital equipment, the principle steps in design and general questions relating to the development of automated design systems. The second chapter, written by S. I. Baranov (Section 2.2 with Ye. L. Polinyy), considers the elements of the theory of automata, which is the basis for the automation of the logical stage of design, presents methods and algorithms for the design of operational and control automata with different structural realizations--with strict logic and on programmed logical matrices. Chapter three written by Yu. P. Sakharov (3.4, 3.6 and 3.7) with B. A. Sapozhnikov (3.1-3.3 and 3.5) is devoted to a consideration of the basic algorithmic methods for developing tests for the control of combinatorial circuits and circuits with memory. The fourth chapter, written by Yu. P. Sakharov, presents methods for modeling functional and logical circuits on a computer. The fifth chapter written by V. A. Selyutin examines algorithmic methods for solving problems in construction design of electronic devices.

The authors would be grateful for critical comments and suggestions and can be reached at the following address: 191605, Leningrad, Gogol' St., 8, "Sudostroyeniye" Press.

CONCLUSION

The development of the theory and practice of automated design of digital equipment is taking place very quickly. It can be established that the greatest successes have been achieved in the realm of the modelling of logical circuits on computers and in the region of automated circuit design. The theoretical basis and results of experimental studies along these lines is a good foundation for the development of software for automated design systems.

The principle problems in the automation of the synthesis of logical circuits are obtaining solutions which rival in quality those of a qualified developer and also the creation of effective procedures for synthesizing circuits based on the use of multi-function logical elements (microcircuits and BIS (Large-scale Integrated Circuits)). In spite of isolated good results, the theory of synthesis of tests for circuits with memory cannot be considered well formed and in this area, evidently, we can expect material progress. This is important in connection with the development of systems based on microprocessor sets.

The main problems in the field of automated circuit design are the development of new models and algorithms for the tracing of connections, development of methods of synthesis for the construction of circuits with irregular topology (microcircuits, printed boards with different sized elements etc.). One of the important trends in the development of the theory of automated design is the performance of the objective analysis of already developed design algorithms. This, without a doubt will be facilitated by the widespread use of the YeS (Unified System) Computer and the unification of languages for describing circuits and constructions.

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MEASUREMENT OF DYNAMIC PARAMETERS OF INTEGRATED CIRCUITS

Moscow IZMERENIYE DINAMICHESKIKH PARAMETROV INTEGRAL'NYKH SKHEM in Russian 1979 signed to press 2 Jan 79 pp 2-4, 78-79, 89-91, 100-103

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[Text] Annotation

Methods of measuring the dynamic parameters of integrated circuits are systematized according to the basic principles of measurement: time scanning, stroboscopic, integrated, time transformation and pulse expansion. The booklet is intended for a broad circle of specialists involved in the measurement of the dynamic parameters of integrated circuits and also for VUZ instructors and students.

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Foreword

It is known that integrated circuits working in the nanosecond range and included in radioelectronic apparatus are characterized by dynamic parameters. Measurement of the dynamic parameters of integrated circuits permits estimating their quality and, if their drift is taken into consideration, calculating the time diagrams of integrated-circuit logical devices. The drift of integrated circuits during their operation is determined by the length of the transitional processes of the switching on and off of transistors and diodes comprising the circuit, the quantities of the input and output capacitive and inductive components of loads and internal capacitances stipulated by the integrated-circuit structure. For example, such time parameters as the delay in switching integrated circuits on and off t^{10}_d and t^{01}_d are explained by the presence of parasitic LC-circuits and also of processes of accumulation and reabsorption of minority charge carriers in the basic regions of active instruments forming integrated circuits.

If the values of the given time parameters exceed the norms established in the technical specifications for the given integrated circuits, that can lead to disturbance of the synchronism of the work of separate cascades of high-speed apparatus and in the final account to unreliable work of the entire apparatus. Therefore of undoubted practical interest are the examination and analysis of methods of measuring the dynamic parameters of integrated circuits in the nanosecond range, and on the basis of them the drawing up of recommendations on the use of the most promising of them in the designing of instrumentation for monitoring certain dynamic parameters of integrated circuits. The present work is devoted to the solution of those questions.

To ease the further comprehension of the material, by dynamic parameters should be understood time parameters characterizing the integrated circuit speed and also the amplitude of the measured pulse.

The brochure consists of three chapters. Chapters 1 and 2 include a classification and description of the principal methods of measuring time and amplitude parameters of singular and recurrent pulses of nanosecond length on integrated circuit inlets and outlets. The most interesting units and elements of structural circuits have been examined with reference to the principal circuits.

Chapter 3 gives a short survey of the main technological characteristics of some models of foreign and domestic instrumentation intended for the measurement of static and dynamic parameters and the testing of the functioning of integrated circuits with low, medium and high degrees of integration. On the basis of analysis of the results of surveying the characteristics of models of apparatus, generalizing conclusions are drawn regarding the great measurement possibilities of the given apparatus and the principles of their construction.

Thus in the brochure an attempt has been made for the first time to systematize the material on the measurement of the dynamic parameters of integrated circuits. In doing so the main attention was given to the most promising methods of measuring both the time and amplitude parameters of integrated circuits in the nanosecond range. It is to precisely those questions that an unjustifiedly small place is given in the literature on radioelectronic measurements, in spite of the urgency of the questions.

The authors express their appreciation to Candidate of Technical Sciences V. I. Ignatenko for his valuable comments on the book's contents.

Comments and suggestions should be sent to "Izdatel'stvo Sovetskoye Radio," Box 693, Main Post Office, Moscow.

3.4. Additional Information About Models of Automatic Instrumentation

The Vakhta-1 model includes a "Saratov" electronic computer, an input-output unit, a computer coupling unit, two double programmed sources of voltage and currents, three commutating matrixes, a digital measuring unit, five measurement panels and a power source. The model permits making functional measurements, classified integrated circuits into 16 groups according to parameters and measures the static parameters of TsIS and BIS (digital and large-scale integrated circuits) of the binary type and on MOS instruments in a wide range of programmed sources of voltage and current. Fig 79 presents a block diagram of the Vakhta-1 model. The absolute error of establishment of the reference voltage is not more than 1.6, 16 and 50 mV, depending on the measured range.

The Probability model includes a "Saratov" electronic computer, two separate measurement frames for the measurement of low-frequency and high frequency static parameters of AIS (automated information system) in the frequency range of 0.1-10 mHz, an input-output unit, a communications unit and five measurement panels. The apparatus automatically establishes the AC regime

for the signal of modulating and carrier frequencies. The sinusoidal signal, directed according to program with respect to frequency and amplitude from the generator of the measurement frame, arrives at the input of the measured AIS. The real value of the signal from the input and output of the circuit is converted by a linear converter into direct current and measured by a digital meter that is included in the measurement frame. The reference voltage is established with an absolute error of not more than 0.5 mV.

The Elekon S-2M model contains a unit for monitoring the static parameters of TsIS, an operator's panel and a programmed control unit. The last-mentioned includes a control unit, an arithmetic unit, a magnetic immediate-access memory and peripherals (a punched tape input, a puncher and a printer). The model breaks down the TsIS into 12 groups and measures 50 static parameters of a circuit per second. The absolute error of establishment of the reference voltage and current does not exceed 1-10 and 100 mV and 1-100 microamperes respectively.

The Elekon SD has an UKS-2 static parameters monitor, and Elekon UKD dynamic parameters monitor, an M-6000 computer with an input-output unit, an engineering station and four measurement panels. The model's capacity is 200-500 tests per second in the measurement of static parameters and 100-200 tests per second in that of dynamic parameters. Programs of parameter measurements and a program for self-checking the good working order of the model. The reference voltage is established with an absolute error of not more than 1, 10 and 50 mV.

The Elekon D1-1 includes a test-pulse generator, a commutating matrix, a load equivalent unit, a stroboscopic meter with a matching device, an automatic programming device and a power source and reference voltage unit. The model measures the following TsIS and BIS dynamic parameters in the time range of 3 - 10^4 nanoseconds, t_t^{10} -- the transition time of the output pulse of the circuit from the logical state 1 to logical state 0, and also t_d^{10} -- the delay time of the output pulse in a circuit switched from logical state 1 to logical state 0, and t_d^{01} -- from logical state 0 to logical state 1. The parameters are measured stroboscopically.

A block diagram of the Elekon D1-1 model is presented on Fig 80. The test-pulse generator 1 forms a series of rectangular measurement pulses which arrive at the measurement circuit input and the load equivalent 3 through the commutating matrix 2. The same series is fed to one of the inputs of a two-channel stroboscopic meter (with a matching device) 4, and on its other input arrives the output pulse of the measured circuit. At moments of comparison of the fast and slow saw-toothed voltages the meter 4 issues a strobe pulse that strobes the output pulse of the circuit of the nanosecond range in amplitude and converts it into a low-frequency interval. In that case the automatic programming device forms a program for the control of the commutating matrix 2, controls the power sources and references voltages unit 6, selects the subrange of measurement of the meter 4, breaks the circuit down in accordance with the established limit of measurement

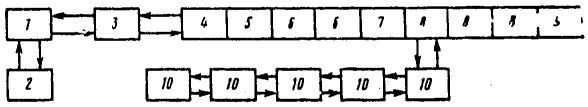

Fig 79. Block diagram of the Vakhta-1 model.

1 - "Saratov" computer
2 - input-output unit
3 - coupling with "Saratov" computer
4 - K-204 digital control
5 - I-203B double programmed source of voltages and currents
6 - I-203A double programmed voltage source
7 - V-202A digital meter
8 - M-201A commutating matrixes (3)
9 - I-205A power pack
10 - portable measurement panels (5)

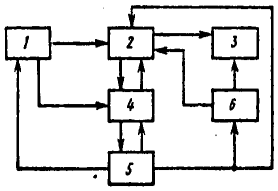

Fig 80. Block diagram of the Elekon D1-1 model.

and remembers the result of measurement. The absolute error of establishment of the reference voltage and current does not exceed 30-320 mV and 1-100 microamperes respectively.

In the measurement of integrated-circuit parameters in the Anait-1M model the integrated circuits are automatically fed in loading cassettes into the position of measurement. After measurement of the parameters the integrated circuits are distributed by means of an automatic sorter into two bins by groups. The dynamic parameters of the circuits (the time of increase of the pulse front t_f^{10} and the pulse drop t_f^{01}) are measured in the range of time intervals of 0.05-50 microseconds. The reference voltage is established with an absolute error of no more than 1, 5 and 10 mV and $3 \cdot 10^{-3}$ - 10^{-2} microamperes respectively.

The IIS-IM model includes a measurer of the static parameters of an integrated circuit, a device for output of the results of measurements, a digital printer and a digital voltmeter. The reference voltage and current is established with an absolute error of no more than 1, 5, 10 mV and 3.10^{-3}-1 microampes respectively.

The IIS-3 model includes a functional pulse generator, a measurer of static integrated circuit parameters with a data input device, a digital printer and a digital voltmeter. The functional pulse generator issues pulses,

Table 3. Main technical characteristics of domestic and foreign instrumentation for monitoring the parameters of integrated circuits with low, medium and high degrees of integration

A Марка модели, фирма, страна	B Виды измерений	C Виды измеряемых схем	D Способ ввода программы измерений	E Способ получения информации и возможность обработки результатов измерений	F Число выводов ИС	G Производительность модели, тест/с	H Диапазон измерения параметров (тока) на выводах схемы	I Литература
1 „Вахта-I"	2 Функциональные, статические	3 БИС биполярного типа и на МДП-приборах, ЦИС	4 Магнитное оперативное запоминающее устройство (МОЗУ) ЭВМ „Саратов" емкостью 4096 12-разрядных слов	5 Индикация „годен—брак", перфоратор, цифровая печать, цифровой измерительный блок	64	100	6 0...±1,6 В, 0...±16 В, 0...±50 В; 8 диапазонов по току: от 0...±1 мкА до 0...±500 мА	[61]
7 „Вероятность"	8 То же	9 АИС, ЦИС, СИС	8 То же	10 Индикация „годен—брак", перфоратор, цифровая печать, цифровой измерительный блок	11 24 для ЦИС, 14 для АИС	—	12 $5\cdot10^{-4}$...$5\cdot10^{-1}$ В без делителя, $5\cdot10^{-3}$...5 В с делителем	[62]
13 „Интеграл"	.	14 ЦИС в корпусах и на пластинах	.	15 Индикация „норма—не норма", перфоратор, цифровая печать	24	10—250	16 0...±1,6 В, 0...±16 В; 6 диапазонов по току: от 0...±1 мкА до 0...±100 мА	[63]
17 „Элекон С-2М"	.	18 ЦИС	19 МОЗУ программного управления емкостью 2048 26-разрядных слов	20 Индикация „годен—брак", перфоратор, цифровая печать, возможность введения результатов измерения в память ЭВМ	20	4—50	21 0...±1 В, 0...±10 В, 0...±50 В; 3 диапазона по току: от 0...±1 мА до 0...±100 мА	[64]
22 „Элекон-СД"	23 Функциональные, статические, динамические	24 ЦИС, БИС биполярного типа и на МДП-приборах	25 ЗУ ЭВМ типа М-6000 на перфоленте емкостью 8192 16-разрядных слов	26 Индикация „годен—не годен", цифровая печать, цифровой вольтметр	96	10^{8}—$5\cdot10^{8}$	27 0...±1 В, 0...±10 В, 0...±50 В; 6 диапазонов по току: от 0...±1 мкА до 0...±100 мА	[65]
28 „Элекон-Дл-1"	29 Функциональные, динамические	30 ЦИС, БИС биполярного типа	31 Постоянное запоминающее устройство (ПЗУ) на полупроводниковых диодах емкостью 1024 бит	32 Индикация „годен—не годен"—группа А—группа Б, стробоосциллограф типа С7-5А	64	10	33 ±(0,1...6)В; 1...100 мА; 3...5000 нс; 3...10 000 нс	[66,67]
34 „Анаит-1М"	35 Функциональные, статические, динамические	36 ЦИС	37 ПЗУ емкостью 1024 адреса по 110 двойных разрядов в каждом адресе	38 Индикация „годен—не годен", цифровая печать, цифровой вольтметр	12	39 720 ИС/ч	40 0,01...10 В; 50 нс...50 мкс	[68]
41 ИИС-1М	42 Функциональные, статические	36 ЦИС	43 Четыре перфокарты емкостью около 3000 бит	44 Индикация „годен—не годен", цифровая печать, цифровой вольтметр	14	6,6	45 ±(0,1...10)В, 0...±5В ±(5...10)В; 100 нА...100 мА	[69]
46 ИИС-11	8 То же	36 ЦИС	47 Пять перфокарт емкостью 7010 бит	48 Индикация „годен—не годен", цифровая печать типа ЭУМ-2311, цифровой вольтметр	14	1,25	49 0,1...20 В; 100 нА...100 мА	[70]
50 ИИС	.	51 ЦИС биполярного типа и на МДП-приборах, динамические сдвиговые регистры на МДП-транзисторах	52 Перфокарты (256 измерительных тестов)	53 Индикация „годен—не годен", цифровая печать типа МП-16П, функциональный импульсный генератор, цифровой вольтметр	16	5,5—10	54 0...±10 В, 0...±30 В; 7 диапазонов по току: 0...±100 мА	[71]
55 Patmo, Тесла, ЧССР	.	56 ЦИС, СИС	57 Две перфокарты	58 Индикация „годен—не годен", цифровая печать, цифровой вольтметр	16	10	59 0...±8 В; 10^{-3}...160 мА	[72]

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Key to Table 3:

A - Trade name, company, country
B - Types of measurements
C - Types of measured circuits
D - Method of measurement program input
E - Method of obtaining information and possibility of processing results of measurements
F - Number of integrated-circuit outlets
G - Productivity of model, tests/second
H - Range of measurement of direct voltage (current) on outlets of the circuit
I - Literature
1 - "Vakhta-1"
2 - Functional, static
3 - BIS of bipolar type and on MOP instrument, devices
4 - Magnetic immediate-access storage of the "Saratov" computer with a capacity of 4096 12-digit words
5 - "Okay-reject" indication, perforator, digital printer, and digital measurement unit
6 - 0...±1.6 V, 0...±16 V, 0...±50 V; 8 current ranges, from 0...±1 microampere to 0...±500 milliamperes
7 - "Veroyatnost'" (Probability)
8 - The same
9 - AIS, TsIS, SIS
10 - Same as 5
11 - 24 for TsIS, 14 for AIS
12 - $5 \cdot 10^{-4}$...5 10^{-1} V without divider, 5 10^{-3}...5 V with divider
13 - "Integral'"
14 - TsIS in housings and on plates
15 - "Standard not-standard" indication, perforator, digital printer
16 - 0...±1.6V, 0...±16 V; 6 current ranges, from 0...±1 microampere to 0...±100 milliamperes
17 - "Elekon S-2M"
18 - TsIS
19 - Magnetic immediate-access storage device with programmed control with a capacity of 2046 26-digit words
20 - "Okay-reject" indication, perforator, digital printer, possibility of input of results of measurement into computer storage
21 - 0...±1 V, 0...±10 V, 0...±50 V; 3 current ranges, from 0...± 1 milliampere to 0...±100 milliamperes
22 - "Elekon SD"
23 - Functional, static, dynamic
24 - TsIS, BIS of bipolar type and on MOS devices
25 - Model M-6000 computer storage on punched tape with a capacity of 8192 16-digit words
26 - "Okay not-okay" indication, digital printer, digital voltmeter
27 - 0...±1 V, 0...±10 V, 0...±50 V; 6 current ranges, from 0...±1 microampere to 0...±100 milliamperes
28 - "Elekon D1-1"
29 - Functional, dynamic
30 - TsIS, bipolar BIS
31 - Permanent storage on semiconductor diodes with a capacity of 1024 bits
32 - "Okay-not-okay," group A - group B, model S7-5A stroboscillograph
33 - ±(0.1...6) V; 1...100 milliampere; 3...5000 nanosec; 3...10,000 nanosec.
34 - "Anait-1M"
35 - Functional, static, dynamic
36 - TsIS
37 - Permanent storage with capacity of 1024 addresses on 110 binary digits per address

38 - "Okay not-okay" indication, digital printer, digital voltmeter
39 - 720 integrated circuits/hour
40 - 0.01...10 V; 50 nanoseconds... 50 microsec
41 - IIS-IM
42 - Functional, static
43 - Four punched cards with a capacity of about 6000 bits
44 - "Okay not-okay" indication, digital printer, digital voltmeter
45 - $\pm$(0.1...10) V, 0...$\pm$5 V $\pm$(5...10) V; 100 nanoamperes...100 milliamperes
46 - IIS-11
47 - Five punched cards with capacity of 7010 bits
48 - "Okay not-okay" indication, digital printer model EUM-2311, digital voltmeter
49 - 0.1...20 V; 100 nanoamperes ...100 milliamperes
50 - IIS
51 - Bipolar TsIS and on MOS instrument, MOS devices dynamic shift registers
52 - Punched cards (256 Measurement tests)
53 - "Okay not-okay" indication, digital printer model MP-16P; functional pulse generator, digital voltmeter
54 - 0...$\pm$10 V, 0...$\pm$30 V; 7 current ranges: 0...$\pm$ 100 milliamperes
55 - Fatmo, Tesla, CCCR Czechoslovak Socialist Republic
56 - TsIS, SIS
57 - Two punched cards
58 - "Okay not-okay" indication, digital printer, digital voltmeter
59 - 0...$\pm$8 V; 10^{-2}...100 milliamperes

the length of which is in the range of 0.2 - $2 \cdot 10^4$ microseconds. The length of a machine word of the generator is 16 bits in that case. The frequency range of the functional measurements is 0.015-625 kHz. The absolute error in establishment of the reference voltage does not exceed 10 and 20 mV, depending on the range of the measured voltage.

The Fatmo model contains a logical function generator, logical level converters, comparators of data on change of input currents and output voltages, two storages with an indication of defects on the input and output of the measured circuit, programmed sources of the reference voltage, a control unit, an integrated-circuit sorter by groups, and a device for the input of programs of input currents, comparison and connection of inputs and outputs of the measured circuits. Fig 81 presents a block diagram of the Fatmo model. The absolute error in the establishment of the reference voltage and current is not more than 10 mV and $1.2 \cdot 10^{-3}$ microamperes respectively.

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2174
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CONCERNING REALIZATION OF SWITCHING FUNCTIONS IN MICROCIRCUITS OF MEDIUM DEGREE OF INTEGRATION

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[Excerpts from paper by Mikhail Arkad'yevich Gladshteyn, candidate of technical sciences, Assistant Professor, Rybinsk Aviation Technological Institute; Vyacheslav Alekseyevich Baskakov, engineer, Scientific-Research Sector, Rybinsk Aviation Technological Institute; and Valeriy Mikhaylevich Komarov, senior engineer, Scientific-Research Sector, Rybinsk Aviation Technological Institute]

[Excerpt] A functionally complete set of assemblies of medium degree of integration for synthesis of combination systems is considered in the paper. A formula is presented for estimating the complexity of structures which reproduce switching functions of a various number of arguments.

Modern microelectronic technology has reached the degree of development that it has become possible to manufacture microcircuits with high degree of integration. The use of medium integrated microcircuits (SIS) and especially of large integrated microcircuits (BIS) permits a significant increase of reliability and a reduction of the dimensions and weight of the computer apparatus (EVA).

However, there is a direct relationship between the degree of integration of microcircuits and specialization of the functions performed by them. The latter circumstance leads to a significant increase of the nomenclature of integrated circuits (IS) produced. For example, series 155 contains seven nomenclatures of counters, four nomenclatures of flip-flops, nine nomenclatures of storage devices and up to 35 nomenclatures of SIS.

At the same time the developer frequently encounters the need to realize individual switching functions (PF) when designing digital automatons. This problem is usually resolved by using microcircuits with low degree of integration (MIS), for example, base logic components of type "AND-NOT" or "OR-NOT" for which the well-developed methods of synthesis are used. This does not permit the exclusion of MIS from components for construction of EVA and leads to a reduction of the degree of integration of the apparatus as a whole. The total composition of series 155 contains 17 nomenclatures of MIS.

Thus, on the one hand, there are universal MIS which permit realization of any finite automaton and on the other hand there are specialized SIS which, by solving the problem of microminiaturization of equipment, have no universality of MIS.

Development of new methods of realizing PF based on SIS would make it possible to do away with MIS, which would significantly reduce the nomenclature of IS used and would lead to an increase of the degree of integration of microelectronic apparatus as a whole.

To solve this problem, one must:

--select a functionally complete set of SIS for synthesis of combination circuits;

--develop a method of realizing arbitrary PF on assemblies of a functionally complete set of SIS.

Series 155 contains microcircuits of medium degree of integration which realize operations of type (4). They include IS of the following types:

155 KP1--a selector-multiplexer on 16 channels with gating;

155 KP2--a dual selector-multiplexer on four channels;

155 KP5--a selector-multiplexer on eight channels;

155 KP7--a selector-multiplexer on eight channels with gating.

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PARALLEL PROCESSES IN DISTRIBUTED COMPUTER SYSTEMS TO SOLVE PROBLEMS OF GREAT DIMENSION

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[Excerpts from article by M. Ye. Berkovich]

[Excerpt] 1. Basic concepts. Formulation of the problem.

The formalized solution of eocnomic problems is primarily based on economic and mathematical models. The most complex model is that of optimum planning of sectors of the national economy. The dimension of input information now reaches more than 10^{12} bytes [1].

Practical solution of an evolved model of an optimum plan can not be handled by a single computer. In fact, this problem can not be realized by known methods because of the large volume of input information and the limited capacity of operative memories. If this difficulty could be surmounted by breaking the problem down into a series of solvable subproblems of realistic size, the transmission of all the initial information required for calculation of the plan would either be too complicated or would sharply reduce the reliability of said information; calculation per se would be impracticable within an acceptable time. In the light of this, the idea of the problem of optimum planning as a system of mutually connected economic and mathematical models has become popular: calculations are realized using several iterative processes.

An important source for enhancing the productivity of a data processing system for such models is the utilization of parallel calculations by means of these iterative processes. The possibility of deparallelizing the calculation processe is defined by the structure of the information medium which permits simulataneous change in the values of many variables distributed in space and time.

Theoretical foundations for realization of parallel calculations based on the principle of a team of calculators was elaborated in [2]. In the same work the idea was formulated for the first time of a distributed computing system (RVS) as a convertor of digital information possessing the following properties:

- several portions of the computational process can be performed simultaneously in various devices of the convertor;

- the devices are located at a distance from each other where the time of signal propagation beween them exceeds the time of execution of the operation by the device.

The word device implies a basic RVC component: an all-purpose computer. Such computers will henceforth be called elementary computers (EM). EM can clearly be interpreted as a computer or complex of computers geographically situated in the same site.

Arrangement of parallel calculations at the level of problem assignments are discussed in studies [2]-[4]. In this article, the specifics of economics problems of optimum planning are considered. To relate the detailed and reinforced indicators, the method was selected of iterative aggregation [5]. In this method, the complex of planning models and general iterative scheme of their interaction formulate a principle of calculation arrangements which would permit each organ to limit the amount of information it needs to small masses. Each organ should concentrate in its hands only the information, and only to the degree of aggregation, which is necessary and adequate to solve the problem of planning and control of subordinate facilities.

Methods of bilevel and unilevel iterative aggregation are analyzed in ths study as they concern the solution of problems of interproduct balance in various organizational and economic systems [6]. In describing parallel algorithms, a convenient language of algorithmic algebras is proposed for structural planning [7] and the effectiveness of such algorithms is considered.

[66]

In conclusion, let us note that the parallel RVC processes considered satisfy the criterion of effectiveness in the sense of equations (23) and (24); reliability is enhanced and cost of elaborating a solution of problems is reduced because of the fact that each branch of this process has an identical structure and therefore the branches are mutually replaceable. Furthermore, the sudden decrease in calculation time makes it possible to increase accuracy by means of additional iterations. For example, for the interproduct balance a 10-day period of calculation (10^6 seconds) is tolerable, and in accordance with Table 2, we find it possible to perform up to 100 iterations.

The algebraic language used for a formal description of parallel computational processes made it possible to shift from the functional level of the economic and mathematical model to the structural-computational level of RVC problem solution. This method of description promotes further structural programming of similar algorithms. The clarity, visibility and natural interpretation of parallel processes under RVC conditions allows hopes for further practical utilization.

The comparison of iterative processes for solving the problem of interproduct balance cited is not final, since in comparative calculations of effectiveness of

algorithms several assumptions have been made. More detailed levels of realization of these algorithms will be studied in the future.

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THE APPLICATION OF A METHOD OF ESTIMATES TO THE SOLUTION OF THE PROBLEM OF HARDWARE PLACEMENT FOR DATA STORAGE IN A COMPUTER CENTER NETWORK

Moscow IZVESTIYA AKADEMII NAUK SSSR. TEKHNICHESKAYA KIBERNETIKA in Russian No 1, Jan-Feb 80 p 216 data received 10 Apr 78

[Abstract of a paper by P.I. Bratukhin, S.A. Piyavskiy and V.A. Smirnov, fully deposited in the All-Union Scientific Research Institute for Scientific and Technical Information under No. 3698-79, 25 Oct 79]

[Text] A mathematical model of the layout of the hardware for automated data banks (ABD), being designed into a collective-use computer center (VTsKP) for the storage of group and individual use data files, is treated.

As a result of the transformation of the target function of the original multiproduct optimization problem, estimates are derived for the change in the criterion value when one of the data files subject to storage is transfered between two of the ABD's being created in the VTsKP. The limiting values of the estimates make it possible to establish the optimum type of topological structure (centralized and maximally distributed) for the placement of the ABD's in the system of the VTsKP network. For the case where the quantity of ABD's being placed is known to be smaller than the number of VTsKP's of a network, but greater than 1, estimates are proposed which make it possible to realize a directed sorting algorithm for finding a placement variant close to the optimal. Results are given for calculations which were performed for a specific computer network being designed.

[260-8225]

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SYNTHESIS OF ASYNCHRONOUS MICROPROGRAM CONTROL OF PARALLEL PROCESSES

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[Excerpts from paper by Ol'ga Leonidovna Bandman; dr of technical sciences, senior scientific research worker, Institute of Mathematics, Siberian Department, USSR Academy of Sciences, Novosibirsk]

[Excerpts] The operating efficiency of parallel computer systems and structures depends on the mechanism which organizes coordinated joint operation of many computers. It becomes necessary to use the asynchronous principle of controlling the interactions of parallel processes and development of methods of apparatus and microprogram realization of it. The theory of finite automatons, both synchronous and asynchronous, is limited by consideration of essentially sequential processes and has no means to determine and take into account the characteristics of parallel operation. A number of investigations has appeared in this regard during the past few years in which methods of description and synthesis of parallel asynchronous control which do not use finite-automaton models, are proposed. The two following approaches were noted. The first approach (the module [1]) consists in the fact that the required set of operators (the basis is introduced such that control of any system of interacting processes can be described by the composition of the basis operators. Synthesis of a control device reduces to construction of a system of automatons which perform functions of the corresponding operators. The second approach utilizes the model of the behavior of the control system (usually in the form of a Petri net [2, 3]) with subsequent conversion from this model to a special programmable structure. Both approaches lead to cumbersome decisions and require development of new types of large integrated circuits. Thus, systematic investigation of the capabilities of microprogram interpretation of parallel control is feasible and the most natural is conversion to equivalent automaton description. First, this permits the use of well-organized methods of finite automaton theory for justifying selection of the variants and postulation of problems of optimization and second it permits synthesis with orientation toward the existing component base.

A formal method of converting from the initial task of an algorithm in the form of a parallel graph-circuit to an equivalent automaton is proposed in the article. Petri nets are used as the behavioral model of controlling calculations. Formal determination of the concept of the equivalents of a Petri net and of finite automatons which simulate asynchronous parallel control is given. Theorems on equivalent conversions of Petri nets which permit them to be reduced are proved. As a result, a method of constructing an abstract automaton equivalent to the given Petri net is derived. The case of synthesizing and automaton with identical mapping of a set of network markings to a set of internal states of the automaton is especially determined. It is shown that matrix realization of the automaton is equivalent in this case to homogeneous programmable Patil structure [4]. Estimates of the complexity of matrix realization are found in terms of parameters of Petri nets.

[264-6521]

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ELEMENTARY MACHINE OF A HOMOGENEOUS COMPUTER SYSTEM WITH PROGRAMMED STRUCTURE

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[Excerpts from paper by Viktor Vladimirovich Korneyev, candidate in technical sciences, Junior Research Worker, Institute of Mathematics, Siberian Department, USSR Academy of Sciences, Novosibirsk]

[Excerpt] A homogeneous computer system (OVS) is a "large collective of calculators"
[1] whose efficient operation can be organized on the following basis:

--the calculating procedures are given in the form of a set of operators and ratios between them;

--the condition for the readiness of the operator to perform is completion of all operators which dynamically precede it.

The following requirements are advanced in this case:

1) the result of calculations should not depend on the order of realization of operators ready for completion;

2) after completion of a calculating procedure, the inputs of all the components of its operators may not have unused values.

Realization of this method of organization of calculations requires a corresponding software-hardware structure of elementary machines (EM) and intermachine couplings.

The purpose of this paper is to select the structure of the elementary machine and mechanism of organization of intermachine exchanges and also introduction of language means which permit control of the order of realization of program operators and which permit programming of the hardware-software interfaces which accomplish interregister transfers both inside the EM and between different EM.

Conclusions

The configuration of a homogeneous calculating system provides an idea of its functioning as of realization of a system of asynchronous processes. The processes which comprise the operational system of the OVS and the processes of the system users interact by means of the same mechanism invariant to the specific conditions of interaction. A synchronizing primitive adjusted to interact by the given subsets of semaphores, which are its parameters, has been proposed as this mechanism. Orgnization of intermachine exchanges by the type of interprocessor communications opens up wide opportunities on the programmability of the structure of a homogeneous calculating system.

In conclusion the author expresses gratitude to O. L. Bandman and S. G. Sedukhin for useful comments during writing of this paper.

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6521
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A PROCEDURE FOR MODELING A ROBOT MOVING IN A SPATIAL ENVIRONMENT

Moscow IZVESTIYA AKADEMII NAUK SSSR. TEKHNICHESKAYA KIBERNETIKA in Russian
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[Excerpts from paper by D.Ye. Okhotsimskiy, A.K. Platonov and V.Ye. Pryanichnikov, Moscow]

[Excerpt] Introduction. Mathematical modeling of a walking robot [1], capable of planning actions and perceiving the environment, was carried out using the display system of the Institute of Applied Mathematics of the USSR Academy of Sciences, which consists of a BESM-6 and a satellite computer. To designate this kind of modeling, it was necessary to solve the problem of constructing a model of the ambient environment (MVS) of the robot [2, 3]. The software which was developed [4] made it possible to program just the BESM-6 and produce magnetic films via an interface channel on the satellite computer for the assessment of the functioning of the robot. The compactness of the ambient environment model [5] made it possible to come up with a rather efficient modeling technology [6] for the robot engineering systems, which was utilized, for example, in [7].

A procedure for modeling the environment, obtaining magnetic films and organizing the interaction between the experimenter and the systems for synthesizing the robot images and the environment on the screen of a graphic display with erasure of the invisible line segments (the IZOROBOT and IZOMVS systems) is treated in this paper.

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[260-8225]

8225
CSO: 1863

UDC 681.51:681.3

A MICROPROGRAM PROCESSOR

USSR Author's Certificate in Russian Cl. G06 F 15/00, No 664173, filed 21 Dec 77, No 2558691, published 28 May 79

DOLKART, V. M., KRAMFUS, I. R., PURE, R. R. and STEPANOV, V. N.

[From REFERATIVNYY ZHURNAL. TEKHNICHESKAYA KIBERNETIKA No 2, 1980 Abstract No 2.81.916 P]

[Text] The invention pertains to computer technology and, in particular, to processor design. The traditional microprogram compressor contains an operating unit (OU), an operating memory, a command counter, and a permanent memory. However, the operating speed of such a device is fairly low, because both the operating-system programs and the users' programs are kept in the operating memory. Closest to the device proposed here, in its essential technical aspects, is a microprogram processor containing an OU connected via its first input and output to the operating memory whose second output is connected to the input of the command counter, whose output in turn is connected to the second input of the OU, whose third input is connected to the first output of the OU of microprogram control, whose second output is connected to the first input of the address commutator, whose output in turn is connected to the input of the permanent memory, whose output in turn is connected to the input of the OU of microprogram control. A shortcoming of the traditional microprogram processor is the loss of time on the selection of operating-system commands from the operating memory. This is particularly important to the design of multiprocessor systems, because in these there may arise conflict situations in which several processors simultaneously require access to the operating memory. The aim of the invention is to increase the operating speed of the processor. The aim is accomplished by incorporating in the microprogram processor a privileged-mode flipflop and an AND element whose output is connected to the second input of the address commutator; the first input of the AND element is connected to the output of the command counter; the second input, to the fourth output of the OU; and the third input, to the output of the privileged-mode flipflop whose input is connected to the fifth output of the OU. The fourth input of the OU is connected to the output of the permanent memory. Figures 1; references 2.

[283-1386]

UDC 681.324

DISTRIBUTED PROCESS CONTROL IN UNIFORM COMPUTER SYSTEMS

Kiev GIBRIDNYYE VYCHISLITEL'NYYE MASHINY I KOMPLEKSY in Russian No 1, 1979 pp 40-48

VOROB'YEV, V. A. and SEDYUKHIN, S. G.

[From REFERATIVNYY ZHURNAL. AVTOMATIKA, TELEMEKHANIKA I VYCHISLITEL'NAYA TEKHNIKA No 2, 1980 Abstract No 2 B18]

[Text] Nuclei of an operating system (OS) for a homogeneous computer system (OPS) are described. The basic terms relating to the OS of UCS are described, as is the structure of an OPS of the SUMMA type used to test these concepts. The effectiveness of the resulting process control system in SUMMA type OPS is analyzed, and ways of increasing the capacity of OPS by abolishing the constraints discovered in the realized system are considered. Figures 4; references 10.

UDC 681.327.8.01

CHANNEL FOR SEQUENTIAL DATA TRANSMISSION BETWEEN REMOTE COMPUTERS

KANAL POSLEDOVATEL'NOYPEREDACHI DANNYKH MEZHDU OTDALENNYMI EVM in Russian, Preprint No 366(24), Yerevan' Physics Institute, 1979 16 pp

AKOPYAT, A. K., VARTANYAN, S. V., VASINYUK, I. YE., DADYAN, A. T. and MARTIROSYAN, G. M.

[From REFERATIVNYY ZHURNAL. TEKHNICHESKAYA KIBERNETIKA No 2, 1980 Abstract No 2.81.321]

[Text] A description of a sequential data transmission channel assuring bilateral data exchange and interfacing between an NR-2126S computer and a PDP-9 type computer at a distance of about 2 km is presented. The information (16 bits) is transmitted by the pulse-width modulation method via a coaxial cable. Circuits and operation of the channel are described.

SOFTWARE

UDC 681:322.068

INVESTIGATION OF THE EFFECT OF OPTIMIZING CONVERSIONS ON THE EFFECTIVENESS OF TRANSLATOR-GENERATED PROGRAMS

ISSLEDOVANIYE VLIYANIYA OPTIMIZIRUYUSHCHIKH PREOBRAZOVANIY NA EFFEKTIVNOST' PROGRAMM, GENERIRUYEMYKH TRANSLYATORAMI in Russian, Institute of Applied Mathematics, USSR Academy of Sciences, Preprint No 154, 1979 15 pp

GORELIK, A. M. and KHARITONOVA, YE. B.

[From REFERATIVNYY ZHURNAL. AVTOMATIKA, TELEMEKHANIKA I VYCHISLITEL'NAYA TEKHNIKA No 2, 1980 Abstract No 2 B106 by T. M. Kuznetsova]

[Text] The effect of a number of optimizing conversions on the effectiveness of translator-generated programs is investigated. A comparative analysis of an optimizing version of the FORSHAG translator and its earlier versions as well as of the FOREX translator is presented. Methods for comparing the effectiveness of programs generated by different translators are substantiated and the results of the comparison are analyzed.
[284-1386]

UDC 681.322.068

LOCAL OPTIMIZATION OF OBJECT PROGRAM IN FOREX TRANSLATOR

LOKAL'NAYA OPTIMIZATSIYA OB'YEKTNOY PROGRAMMY V TRANSLYATORE FOREX in Russian, Institute of Applied Mathematics, USSR Academy of Sciences, Preprint No 149, 1979 25 pp

SHTARKMAN, V. S.

[From REFERATIVNYY ZHURNAL. AVTOMATIKA, TELEMEKHANIKA I VYCHISLITEL'NAYA TEKHNIKA No 2, 1980 Abstract No 2 B107]

[Text] Optimization techniques used in the Forex translator to improve the quality of object programs are described.
[284-1386]

UDC 681.3:002.513.5

MEANS OF PROCESSING TEXTUAL INFORMATION FOR THE FORTRAN LANGUAGE

SREDSTVA OBRABOTKI TEKSTOVOY INFORMATSII DLYA YAZYKA FORTRAN in Russian, Institute of Applied Mathematics, USSR Academy of Sciences, Preprint No 145, 1979 10 pp

GALATENKO, V. A. and YESINA, N. A.

[From REFERATIVNYY ZHURNAL. AVTOMATIKA, TELEMEKHANIKA I VYCHISLITEL'NAYA TEKHNIKA No 2, 1980 Abstract No 2 B120]

[Text] A subroutine is described, realized on a BESM-6 type computer within the framework of the "Dubna" monitoring system and serving to operate with chains of alphabet characters.

[284-1386]

UDC 681.322.066

THE YeS-77 MACROSYSTEM

Kishinev YeS-77 MAKROSISTEMA in Russian, Shtiintsa, 1979 193 pp

TODOROY, D. N. and AKHEGUKYAN, A. V.

[From REFERATIVNYY ZHURNAL. AVTOMATIKA, TELEMEKHANIKA I VYCHISLITEL'NAYA TEKHNIKA No 2, 1980 Abstract No 2 B80 K by T. M. Kuznetsova]

[Text] The YeS-77 macrosystem, serving to broaden the potential of computer software, is described. Overall data on macroprocessors, their circuits and ranges of application, and macrosystem requirements are presented and the possibilities for using the YeS-77 macrosystem to expand the PL/1 language and to construct database control systems are considered.

The macrolanguage and macroprocessing in the YeS-77 macrosystem are analyzed. Macrorequests, various functional macrodistributions, and means of conditional generation are described. Macrolibrary structure, personal macrolibrary files, and the functions of the MACROLIBRARIAN are examined. Processes of correction, cataloging, deletion, renaming, updating, compression, distribution, duplication, etc. are described. The appendices present printout samples, code tables, examples, and directions.

[284-1386]

UDC 681.322.066

APPLICATION PROGRAM BATCH OF THE "OPERATIONAL ACCOUNTING" SUBSYSTEM

PAKET PRIKLADNYKH PROGRAMM PODSISTEMY "OPERATIVNYY UCHET" in Russian, Preprint No 193, Computer Center, Siberian Department of the USSR Academy of Sciences, 1979 29 pp

AKSENOV, V. V., VORONIN, YU. A. and MAZHUL', G. P.

[From REFERATIVNYY ZHURNAL. AVTOMATIKA, TELEMEKHANIKA I VYCHISLITEL'NAYA TEKHNIKA No 2, 1980 Abstract No 2 B81 by T. M. Kuznetsova]

[Text] A set of accounting programs is proposed, designed to handle the factual part of the data array with respect to labor expenditures; duration, cost, and time of task implementation for correction of any essential element of the data array; for delivery of monthly, quarterly, and annual reports and signals on the fulfillment of plan-set projects. The programs are realized on a FC series computer with a magnetic main storage capacity of 256 K bytes and three disc guides. General information is presented on the batch of programs. Methods for the solution of problems are described. Block diagrams of the programs and a text in FORTRAN in the form of a listing of the PPORTRAN translators are presented, as are instructions for the setup of input data, instructions to the operator, and an assessment of the results of the solution. A reference sample is presented. Figures 15; references 3.

[284-1386]

UDC 680.51:621.38

PRINTED CIRCUIT EDITING PROGRAM

Dubna PROGRAMMA REDAKTIROVANIYA PECHATYNYK SKHEM in Russian, Preprint No R11-12530, United Institute of Nuclear Research 1979 10 pp

KHUTORNOY, N. V.

[From REFERATIVNYY ZHURNAL. TEKHNICHESKAYA KIBERNETIKA No 2, 1980 Abstract No 2.81.955]

[Text] A program for editing single- and double-layer printed-circuit boards is developed. The proposed editing language facilitates revisions of the existing circuits. The editing language, program, and printout are described. The program is written in FORTRAN and used in SDS-6500 and BESM-6 type computers. In the BESM-6 type computers the program is included in the "GRAF" system.

[283-1386]

UDC 518.512

ALGORITHMS FOR CELESTIAL MECHANICS (COMPUTER SOFTWARE MATERIALS)

Leningrad ALGORITMY NEBESNOY MEKHANIKI in Russian 1978 signed to press 29 Mar 78 pp 2, 3, 4, 28

[Excerpts from the book by V.B. Novosel'tsev, edited by V.A. Brumberg, "Procedural Materials on Computer Software, Institute of Theoretical Astronomy of the USSR Academy of Sciences, Algorithms for Celestial Mechanics, No. 18", 200 copies, 29 pages]

[Excerpt] For the Information of Readers

Information on materials arriving at the library of algorithms and programs of the Institute of Theoretical Astronomy of the USSR Academy of Sciences are published in the editions of "Algoritmy Nebesnoy Mekhaniki" ["Algorithms for Celestial Mechanics"]. When using these materials, we request that the appropriate references be made, indicating the number of the edition. The programs themselves on punched cards can be sent out free of charge to the address of interested organizations. Direct inquiries to the following address:

192187,
Leningrad, D-187
Nab. Kutuzova, dom 10,
Institute of Theoretical Astronomy of the USSR Academy of Sciences, Library of Algorithms and Programs,
Telephone 278-88-58

New Double Precision Subroutines for the DUBNA Monitor System using the BESM-6 Computer

Introduction

The present paper is devoted to the question of reducing expenditures of machine time for the performance of arithmetic operations on double precision numbers in the DUBNA monitor system (MS DUBNA) using the BESM-6 computer.

The standard double precision subroutine, DUBLPREC, which operates in the MS DUBNA [2], works with numbers for which not only the length of the mantissa is doubled, but also the range of the representation is also expanded

as compared to the machine representation by virtue of increasing the bit configuration of the order of magnitude. The latter circumstance significantly slows down the operation of the corresponding subroutine. At the same time, in a number of cases where the calculations are made with numbers which do not go beyond the limits of the standard machine range of variation in the orders of magnitude, one can employ economical algorithms.

For this purpose, two new subroutines were worked out on the basis of the text of the standard DUBLPREC subroutine. They have the same structure (input names, agreements concerning connectives, manner of parameter transmission etc.) as the original one, something which makes it possible to use the subroutines developed here without changes in the standard translator from the FORTRAN language. Either of the two proposed subroutines can be used by means of replacing the DUBLPREC subroutine system by it. This is accomplished wither by including punched cards with the requisite subroutine in the problem packet, or by reading it out from a personal user library, in which it should be placed beforehand.

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4. Usov, S.A., Chaykovskiy, M.G., "Sravneniye proizvoditel'nosti BESM-6 i YeS-1050 na nekotorykh prostnykh zadachakh" ["A Performance Comparison of the BESM-6 and YeS-1050 on Certain Simple Problems"], Moscow, IPM AN SSSR, Preprint No. 42, 1974.

[279-8225]

8225
CSO: 1863

PROGRAMMING

Moscow PROGRAMMIROVANIYE in Russian No 1, 1980

[Excerpts from the journal PROGRAMMIROVANIYE No 1, 1980]

[3]

The problem of realizing cycles of special type is considered. The property of optimum realizations, which permits one to limit the range of their retrieval is established.

[11]

The method of formalized deparallelling cyclic program structures written in Fortran-type algorithmic language is presented. The method permits rather satisfactory determination of parallelism in cyclic program structures of arbitrary configuration.

[24]

The multiprocessor configuration of large computers is one of the means of increasing their speed since the speed of calculation can be increased approximately in proportion to the number of processors if the problem algorithm permits calculations on all processes simultaneously.

We will be interested in systems with large OZU [Storage devices] for processes.

Specifically, one of the most important factors is selection of the information exchange system between parallel branches of the general problem-solving algorithm realized on different processes.

One must first decide whether deparallelling of calculation for a given problem is necessary to solve the problem of using a single resource of a multiprocessor computer complex. We feel that two classes of solved problems can be determined for which this deparallelling is desirable:

1) problems which occupy the entire internal storage of the complex;

2) problems which require minimization of calculation time (for example, dialogue problems with automatic design or real-time problems).

If the requirement in second-class problems on deparallelling is determined by minimization of calculation time, economic factors are significant for first-class problems since only one of the processes is used without deparallelling, while the remaining ones will stand idle.

The main goal of the given paper is to show the possibility of more complete loading of the processes of the computer complex in solving physical problems which utilize the entire internal storage and which thus increase the efficiency of the system.

[30]

An algorithm for determining a set of active program segments which eliminates storage fragmentation is proposed. It is based on analysis of the dynamic matrix of intersegmental transitions; its high effectiveness is determined by modelling data.

[41]

A class of translation schemes, called "translation schemes with retention of phrase structure," is determined and an algorithm for realizing these schemes is proposed. Examples are presented which show the suitability of the formulated results when realizing translators and translation systems.

[51]

During the mid-1970s, several collectives, independently and practically simultaneously, developed experimental testing systems using symbolic fulfillment of programs. Part of them posed as their main goal total automization of test generation [13, 16, 24] (in this case the test should purposefully and sufficiently fully check the program in opposition to randomly generated tests). Others attempted to consider program operation on their entire class rather than on a specific test. The final goal of this fulfillment is determination of the conformity between classes of input and output data [18, 25-27].

[57]

Name of system--SMOTL; authors--Ya. Ya. Bichevskiy, Yu. V. Borzov, M. P. Vasilevskiy, A. K. Zarin'sh and U. M. Strauyums; location of development--Computer Center of the Latvian State University, Riga, USSR; packet; type of symbolic interpretation--I no formula derivation; test generation--+; input language--Smod; confirmation check-- -; year of first publication--1977; method of selecting analyzed routes--selected automatically;

remarks--it is the only one of the enumerated systems which is oriented toward data processing problems.

[60]

Information retrieval systems which utilize the natural language of scientific information with restrictions as the external language (input and output) have recently found ever wider application. Internal, machine representation of text (sentences) based on a specific model of a natural language is used to form the search images of requests, documents or factorographic lists. Selection of the natural language model depends on the subject area of text information processing, the nature of its processing in the presence of means for text processing.

The input information retrieval language Normin, which is a simplified normalized scientific text information language [1], has been developed to process medical and medical and technical information in the automated factorographic information-logic system (AFILS). Normalization includes clear determination of the sentence structure, restriction of the composition and fixation of the meaning of prepositions and other semantic copuli.

[67]

The described algorithm for semantic-syntactic synthesis of normalized sentences is the first approach to the process of semantic-syntactic synthesis. It permits construction of standardized normalized Russian sentences which provide sufficiently accurate and complete representation of the meaning of sentences to man in the presence of a number of grammatical and stylistic errors. This algorithm can be the basis in constructing similar algorithms for synthesis of normalized sentences in other languages from unified machine encoded representation of these sentences in the Normin system.

[68]

A method of economical organization of number files is proposed which provides rapid repeat determination of an index and the values of the minimum element after entry of a single-element change in the file.

[77]

Buffering of the element registers of the aggregative model of a complex system is considered. The given approach can be used for a wide range of simulation systems and modelling languages.

[82]

The software of a programming system, which is the main element of statistical data analysis, is described. The system is realized with regard

to the characteristics of the ICL-1906 computer, its configuration and mode of use. The experience of operating the system showed the correctness of the methods and concepts employed.

[92-94]

The All-Union Seminar "Prospects for Development in Systems and Theoretical Programming" was held from 20 through 22 March 1978 at Novosibirsk Akademgorodok. The seminar was conducted by the Computer Center of the Siberian Department of the USSR Academy of Sciences.

The current state of the art and prospects for development of the following trends in systems and theoretical programming were discussed at the seminar:

1. Mathematical bases of systems programming.
2. Methods of synthesis, verification and debugging of programs.
3. The technology of programming.
4. Programming languages and methods of describing and realizing them.
5. The software of multiprocessor systems and parallel programming.
6. Data bases and systems for controlling them.
7. New means of communication with computers.

A total of 141 specialists from 33 cities of the Soviet Union participated in the work of the seminar. Two academicians and five corresponding members of the USSR Academy of Sciences and the academies of sciences of the union republics participated as authors of reports and delegates.

There were 12 invited reports and 38 position addresses delivered at the seminar. Both well-known specialists in systems and theoretical programming and young scientists participated actively in the work of the seminar. Discussions of the reports and a specially organized general discussion were very useful. The outlining procedure in the survey presented below corresponds approximately to the topic of the trends discussed at the seminar presented above.

Problems related to research in the semantics of algorithmic languages and related problems of program verification and debugging are now attracting wide attention. The series of communications on this topic was opened by S. S. Lavrov's report (Leningrad), who distinguished the main approaches to determination of programming language semantics.

B. A. Trakhtenbrot (Novosibirsk) devoted his main attention to algorithmic logic in his communication.

R. A. Plyushkyavichyus (Vil'nyus) considered the difficulties related to proof of the partial correctness of parallel programs.

The talk of V. A. Nepomnyashchiy (Novosibirsk) was devoted to practical verification of programs.

Problems of the solvability of various aspects of the equivalents of program schemes and construction of equivalent conversion systems are related to fundamental problems in programming theory.

R. I. Podlovchenko talked about the latest results achieved in investigation of these problems at Yerevan.

A new concept--information-logic (IL) structuring of programs--was proposed in the communication of V. E. Itkin (Novosibirsk) and it was shown that any program can be converted to an equivalent, IL-structured program.

I. V. Pottosin (Novosibirsk) talked about the role and methods of program optimization. It was noted that methods of optimization are used not only in the translation process to increase program quality, but also in automatic construction (synthesis) of programs--for derivation of programs from specifications, for program assembly from the constituent parts and for making universal programs for specific and also in checking the correctness of programs. Different methods of optimization were compared from the viewpoint of their convenience for these implications.

The communication of Ye. A. Zhogolev (Moscow) discussed syntactically controlled construction of texts to facilitate and accelerate the process of program compilation.

Mathematical models, which are the basis of the design language of multiprocessor systems jointly with their software, were briefly described in the communication of Letichevskiy and Yu. V. Kapitonova (Kiev).

A. A. Letichevskiy (Kiev) gave a report "Some Results of Research on Systems Programming" at the Institute of Cybernetics of the Ukrainian SSR Academy of Sciences in the name of a group of authors. Investigations on the technique of designing computer systems and complexes and the method of formalized technical assignments were discussed.

The main concepts of the R-technology of program production were outlined in the report of I. V. Vel'bitskiy (Kiev). This technology is based on clear assignment of the program relationship to data.

Ye. M. Lavrishchev (Kiev) talked about the approach to the industrial technology of large program manufacture in his communication.

S. M. Abramovich (Rostov-na-Donu) presented a communication on the work of A. L. Fuksman (deceased) on the technology of developing complex program systems.

In his communication, S. E. Kozlovskiy (Novosibirsk) talked about the set of programming tools for automation of programming system accompaniment.

The development of applied program packs to support computer experiments was discussed in the reports of A. A. Samarskiy and also of V. Ya. Karpov and D. A. Koryagin (Moscow). The configuration of packs was considered in the reports.

Programming style in the MASON system was discussed in the communication of V. L. Temov (Leningrad).

V. N. Faddeyev (Leningrad), in his communication, considered some problems of developing software by numerical methods and problems of training qualified specialists.

V. Sh. Kaufman (Moscow) related the projection approach to translator development in his report.

The purpose of V. N. Agafonov's (Novosibirsk) communication was to refine the relationship between the syntax and semantics of programming language.

A. S. Kleshchev (Vladivostok) offered the relation model for description of program languages in his report.

T. V. Klokachev (Leningrad) analyzed the main factors which affect development of algorithmic languages.

A. A. Krasilov (Moscow) considered the approach to solving the problem of formation of an effective programming language for development of control computer software.

G. S. Tseutin (Leningrad), in his communication, described the distinguishing features of ALGOL-like language of ASOL systems programming.

The technological decisions made during realization of ALGOL-68 on the YeS EVM [Unified computer system] was discussed in the communication of A. N. Terekhov (Leningrad).

The theory of error correction was discussed in the communication of S. B. Kritskiy (Rostov-na-Donu).

The theoretical and applied aspects of program filtration and construction of filters by mobility, readability and reviewability, by the value of input parameters and structure of programs was discussed in the communication of R. L. Smelyanskiy (Moscow).

Problems related to software adaptation were considered by M. Ye. Nemenman (Minsk).

V. Ye. Kotov's (Novosibirsk) report was devoted to problems of developing parallel programming.

Problems of parallel programming for multiprocessor and multimachine real-time systems were discussed in the communication of B. A. Golovkin (Moscow).

Problems of organizing parallel-series calculations in a computer system were touched on in the communication of A. V. Maksimenkov (Moscow).

In his report, N. N. Mirenkov (Novosibirsk) indicated one item of confusion related to service shutdowns in comparison of different primitives for synchronization of processes.

The first operational experiment at the El'brus-1 computer complex was related in the communication of V. M. Gushchin (Moscow).

The evolution of data control systems was discussed in the report of G. K. Stolyarov (Minsk).

Different approaches to construction of SUBD [Data base control systems], based on data base models, were considered in the report of A. V. Zamulin (Novosibirsk).

F. I. Deberdeyev (Tashkent) formulated the problems which require solution in development of data bases for decision-making based on adequate models of the problems medium.

The main concepts related to abstract types of data and the prospects for using these concepts in systems programming were discussed in the communication of A. I. Ilyushin and V. S. Shtarkman (Moscow).

V. L. Katkov's (Novosibirsk) report was devoted to general problems of machine graphics.

One future trend of machine graphics development was discussed in the report of V. I. Fishelev (Novosibirsk).

V. I. Dvorzhets and V. A. Debelov (Novosibirsk) reported on the new graphical system SIGAM (graphic archive and module system)--development of the widely used SMOG system.

A. S. Narin'yani (Novosibirsk) talked in his report about developing natural language as a new step of program development.

I. R. Aksel'rod (Khar'kov), in his communication, formulated the requirements on dialogue systems from the viewpoint of their "intellect."

R. N. Abaydullin's (Kazan') communication was devoted to prospects for use of time-sharing systems in the academic process.

A number of talks were devoted to finding new methods and concepts in programming.

The question of developing deductive methods in programming was raised in the report of S. S. Kamynin and E. Z. Lyubimskiy (Moscow).

E. Z. Lyubimskiy talked in his communication about the possibilities of using the ideas and concepts of a collective in the structure of complex program systems.

The rule for comparison of the degrees of nonprocedure of equivalent requests was proposed in the report of I. B. Zadykhaylc (Moscow).

N. N. Nepeyvod (Izhevsk) talked about some possibilities of constructing nonprocedure languages based on intuition logic.

A number of problems related to training of specialists for systems and theoretical programming was discussed in the communication of A. N. Kostovskiy (L'vov).

In his summary report, A. P. Yershov (Novosibirsk) discussed some trends typical for timely problems of programming such as development of programming languages, translation, data bases, operational systems and so on. It was specifically noted that typical for development of algorithmic languages is introduction of complex control structures, abstract data and means of nondeterminism and parallelism. In the opinion of the reporter, data bases, interaction with which will be accomplished in natural language, should occupy a visible position. It was emphasized that translators and operational systems are more and more losing their specifics as special information processing systems. Problems of program teaching in the country's higher educational institutions were also touched upon; specifically, the need to change academic courses on informatics was noted.

We note in conclusion that the seminar program was a saturated and diverse one which touched on practically all aspects of systems and theoretical programming. The seminar participants became acquainted with a large number of specific program projects, with the method of constructing modern program systems, were able to follow the trends of modern programming development and to evaluate its further prospects.

Proposals of an organizational order were advanced in the reports and discussions, specifically, attention was turned to holding All-Union conferences on programming.

The proceedings of the seminar were published by the Computer Center of the Siberian Department of the USSR Academy of Sciences. (signed) V. K. Sabel'fel'd and M. B. Trakhtenbrot.
[261-6521]

6521
CSO: 1863

UDC 658.012.011.56

DATABASE OF AN AUTOMATED DOCUMENT EXECUTION MONITORING SYSTEM

Moscow TEKHNIKA OBESPECHENIYA ASU [Software Techniques for Automated Control Systems] in Russian, 1978 pp 93-107

ALEKSANDROV, A. A. and LUKACHEV, V. G.

[From REFERATIVNYY SBORNIK. ORGANIZATSIYA UPRAVLENIYA No 10, 1979 Abstract No 10.67.124 by Yu. P. D.]

[Text] The automation of implementation checking is intended to enhance its effectiveness and improve its quality and, on this basis, to upgrade the operating techniques of the apparatus of control. An automated document execution monitoring system (ADEMS) has been developed for use in large administrative, production, and scientific organizations. Currently the system is undergoing operating trials at the USSR State Committee for Science and Technology, where it is used for: data retrieval at the Administrative Office and in the management of the Committee's structural subdivisions; recording of incoming documents; and data retrieval for the reporting specialists. The data retrieval service in ADEMS is organized on the basis of the creation of a database containing information on the recorded documents and monitorable assignments; the development of a data control system as a means for administering the database; the development of a set of routines for checking data, loading them into the database, and issuing them. The ADEMS has been developed to fit in with the use of Soviet-produced third-generation computers--the YeS computers. At the State Committee for Science and Technology the ADEMS operates on the basis of the YeS-1030 computer system. The system's software has been developed on the basis of the PL/1 programming language. Methods for storing data in ADEMS on the basis of the database organization are described, as is its logic and physical structure. [120-1386]

UDC 681.325.5

MODEL OF A COMPUTING SYSTEM ON THE LEVEL OF INTERVAL USE OF RESOURCES

Riga AVTOMATIKA I VYCHISLITEL'NAYA TEKHNIKA in Russian No 1, 1980 pp 18-22
manuscript received 21 Sep 78 (20 Feb 78)

[Article by M. B. Tamarkin, V. D. Mal'shakov and A. R. Timoshenko]

[Excerpts] In work based on a representation of job processing as a semi-Markov process with incoming flow, we obtained functions for the throughput capacity of a computer system, and also of the load of the processor and logical channel at the level of interval use of resources as a function of the number of physical channels, the number and types of jobs in the mix, and time interval of control, relative to processing interrupts.

The program, written in PL/1 contains 242 operators. A single calculation of the characteristics of the system takes 5-6 seconds of processor time and 70 K of primary memory.

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PROGRAMMING IN LISP

Moscow PROGRAMMIROVANIYE NA LISPE in Russian, Vychislitel'nyy Tsentr Akademii Nauk SSSR, signed to press 19 Apr 78 pp 3-5, 17-19, 28-30, 55-58, 75-78, 95-97, 102-103

[Excerpts from collection edited by Bryabrin, Vych. Tsentri, AN, SSSR, 100 copies, 103 pages]

[Excerpt]

Foreword [3]

In recent years more and more attention in computer utilization has been drawn to problems related to processing of symbolic information such as analysis of formal languages, conversion of algebraic expressions, informational lgoci systems, etc.

Solution of such problems is, to a great extent, determined by the "intellectual prowess" of the programming system utilized.

LISP is a widely used basic programming language for realizing these problems on computer. The studies presented in this collection are devoted to enlarging the possibilities of the LISP system.

The article of V. V. Kobelev, V. N. Yudin and V. M. Yufa contains a description of the BIBLISP system which permits input and use of a functional library in peripheral memory.

In V. G. Abramov's article is considered a system which plans and organizes start-up in the LISP-BESM-6 system of programs written in other programing languages.

In the study of S. I. Bykhovskiy and V. M. Yufa is described the MPL systems which enables us to use a reset mechanism, program sample request and other devices for creating artificial intelligence systems.

In the article of V. G. Abramov and M. G. Pkhovelishvili, a description is given of a system of logical deduction in an "intelligent" data base which carries on an active dialog with the user.

The articles of V. M. Bryabrin, S. I. Bykhovskiy, M. G. Pkhovelishvili and A. A. Eligulashvili are devoted to the creation of information systems based on devices already incorporated in the LISP system.

The authors hope that the studies published in this collection will attract the attention of the reader to the use of the LISP system and further enlargement of its possibilities.

[4]

When any complex problem is solved in LISP language, a large number of functions must be input. For example, a system for operation with polynomials [1] contains 85 functions; a LISP interpreter from Microplenner language has 105 functions. Definitions of functions are usually stored on mag tape and are requested to main memory by the computer before starting problem solution. This arrangement is inconvenient in that as the function necessary to solve the problem is requested, unused functions are also requested. These functions unjustifiably take up space in main memory; in the best situation, calculation is retarded because of superfluous access to the "scrubber", but their presence may also lead to curtailment of calculation of the problem because of a lack of memory.

Functions which are not used in a given problem may, of course, be removed form main memory by the corresponding access to the built-in REMPROP function, but the detection of unnecessary functions is very labor-intensive because of the complex structure of cross references.

The aforementioned shortcomings have been eliminated in the BESM-ALGOL system where there is a flexible mechanism for procedure request from the library [2]. The library catalog contains information on which procedures are necessary for operation of a preset procedure. When requesting the necessary algorithm from the library automatically by a system of references all algorithms necessary for operation of the requested one are also requested.

This library structure for LISP language is similar with that of the BESM-ALGOL system. In contrast to a system in which all operations with the library are serviced by discrete autocode programs, in the library system described below all operations—system formation, opening of new library, entry into library etc.—are carried out by LISP language statements.

The library system described (BIBLISP system) is designed for use in the BESM-6 computer together with a variant of LISP language described in studies [3, 4]. The BIBLISP system operates with the interpreter from 23-08-74. The desirability of creating a LISP language function library was discussed in [4]. Many of the wishes expressed there are implemented by this system.

[17]

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[18]

PLANNING AND ORGANIZATION OF CALCULATIONS IN AN INFORMATION LOGIC SYSTEM

1. Introduction

1.1. Structure of dialog information-logic system (DILOS) and location of the computer processor (VP) in it

The DILOS system developed at the Computing Center of the USSR Academy of Sciences is designed to solve computing, information and logic problems. The system communicates with the user in a language similar to a natural one [1]. Information from the user is converted by a linguistic processor (LINGP) into an intermediate formal language ϕ, after which the received communication is classified. According to the kind of communication, it enters the input of either the information-retrieval processor (IPP), logic processor (LOGP), or computing processor (VP) which together with the LINGP form the basic nucleus of the DILOS system.

The data base with which each processor communicates directly or indirectly is divided into two primary sections: main data base (GBD) and model data base (MBD). GBD objects are applied programming modules (PPM) and data modules for it (MD). Objects forming the MBD reflect the model of the studied problem region, patterns defining the logical relationship of objects, and PPM and MD descriptors situated in the GBD. The structure of MBD objects is thoroughly investigated in study [2].

The division of the data bases into GBD and MBD seems wise because in this case, the model of the studied problem region may be depicted in MBD situated in the memory of one computer while GBD representing the "tremendous bulk" of PPM and MD may be spread out in various computers. GBD objects are reflected in MBD by means of PPM and MD descriptors.

In the DILOS system structure reflected in Figure 1, the computing processor is linked with LOGP and through it to IPP and thereby communicates with both MBD and GBD. Furthermore, communication of the system with the main data base occurs only via VP.

The computing prcoessor may be used only with LINGP, forming a computing system communication with which occurs on professional language. Actions of VP may be initiated in operation of LOGP or IPP, when specific results must be obtained by calculating a PPM sequence. The VP is used to form new data received from initial data by means of calculations.

[28]

4.2. Realization

A prototype of the computing processor described in this study is currently realized in the LISP language in the BESM-6 programming system of the Computing Center of the USSR Academy of Sciences. An initial variant for PPM is ALGOL-60. Among the merits of VP is the possibility of easy start-up of PPM programs and the execution of a planned chain of interrelated PPM. The user can be unaware of the structure of these PPM, only communicating to the computing processor information about the initial data during the dialog process.

Work on the VP continues toward an expansion of the set of programming languages for PPM, improvement of VP statement syntax, use of auxiliary data bases as GBd components, increasing the efficiency of the computing processor etc.

The author is grateful to V. M. Bryabrin and G. V. Senine for numerous discussions of the structure and function of VP; and also to V. M. Yufa for many consultations on the operation of the LISP interpreter.

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[30]

The MPL language is designed for describing complex sorting processes. It is similar to the Micro-Planner language [1] which is a subset of the language PLANNER (author C. Hewitt [2]). Micro-Planner was realized at MIT (authors of realization G. J. Sussman, T. Winograd, E. Charniak). The interpreter of MPL language was realized in the LISP-BESM-6 programming system [3, 4] at the USSR Academy of Sciences' Computing Center.

In the first section is considered the solution of simple problems by devices of the MPL system with the aim of providing a general idea about the features of MPL language. The next section contains a precise description of the language. The contents of the first section have been used to demonstrate specific elements of the language and methods of programming. The third section contains some information about the interpreter and instructions on the use of the MPL system.

[55]

The MPL system proposed in this study has many shortcomings:

1) inconvenient syntax (rigid, many parentheses);

2) low efficiency in speed (examples 1.2 and 1.3 require 20-40 seconds on BESM-6) and in memory;

3) error diagnosis is inadequately developed.

Some of these shortcomings will be surmounted by improving the LISP system [5] and improving the MPL interpreter (elements of the theorem medium will be retained in external memory to reduce the burden on operative memory).

Among the merits of the system are simplicity of expansion and alteration of the system as well as simplicity of transfering it from one computer to another (if the computers has LISP systems). It is thought that MPL can be useful for work on systems proving theorems, on information systems permitting complex requests, on systems of planning and control of robot actions, etc. Experience suggests, as far as MPL fits similar applications, which changes and additions must be made or in which direction to proceed in constructing programming systems for the above problems.

The authors are indebted to V. G. Abramov, V. M. Bryabrin, V. V. Kobelev and V. N. Pil'shchikov for assistance rendered at various stages of elaboration and debugging of the system.

[56]

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5. Yufa, V.M. Solver in LORD system. Ibid, vyp. 2, 1975.

[57]

In modern informational logic systems which manipulate a large quantity of comprehensive information, great meaning is shown by mechanisms of logical deduction underlying them. In this study is considered the logic processor which is a component of the overall Dialog Informational Logic System (DILOS) [1], but which simultaneously has independent meaning and may be used as a discrete logic system.

The logical processor (LOGP) is designed for servicing user requests based on investigation and modification of the "model of the external world" reflected in

the data base.

Let us examine the basic functions underlying the LOGP:

1) Suppletion and modification of the model data base (MBD) by using information contained in input communications as well as information representing a running "model of the external world".

2) Retrieval and output of a response to a question contained in the input communication.

3) Planning of computations consisting in fact that based on initial data and description of required results, the system attempts to build a sequence of requests of special functions or applied program modules using the "model of the external wordls". The resulting sequence forms the algorithm for solving a specific but previously unexamined problem.

4. Planning of actions when given initial and goal situations characterizing the position of a specific object under some circumstances, and the existing model and description of these situations permits the system to construct a plan of actions of the object.

[75]

The data base must be loaded by the systems analyst who knows the essence of the model being studied and used as well as the LOGP structure. The use of the system, however, is also available to the untrained user who utilizes the functions ADDR, CHANGER, DELR and CHECK.

In the future, with the aid of a linguistic adapter, communication with the system will be possible in a language maximally similar to natural language [6]. Often in the work process, LOGP conducts a dialog with the user if the problem is incorrectly stated or inadequately defined for LOGP and the data base which it has at hand. In the dialog process, the user actively intervenes in the flow of the problem solving.

LOGP represents a system consisting of a set of LISP functions [7, 8].

At the moment of writing of this study, LOGP is being successfully used to realize and utilize the SPORT system [9] which permits manipulation of information about instructions, players, umpires and games and matches of sports tournaments. Together with the computer processor [10] was realized a system for planning sector resources and a system for simulating energy resources.

We hope that LOGP, the basic processor of the DILOS system, will interest the reader and will find even wider application.

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[77]

Construction of information systems based on such algorithmic languages as Micro-Planner [1] or MPL is considered by the authors be an approach to the creation of intelligent information systems performing nontrivial logic processing of information.

Below are described MPL language devices used in arranging data systems and a special language INFMP which is a version of MPL language oriented to communicate with the information system through the PUL'T system [2, 3]. The examples utilized were taken from the INFVTs information system which reflects several elements of the administrative and scientific structure of the USSR

Academy of Sciences Computer Center.

[95]

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[96]

The dialog information retrieval system of the factographic type SPORT is designed for servicing sports tournaments by providing these events with the necessary information.

[97]

The SPORT system is based on the DILOS system.

The dialog information logic system (DILOS) [1] is designed for solving computing, information and logical problems as well as for performing dialog between man and computer in a language most similar to natural language. In accordance with this purpose, DILOS consists of five processors: linguistic, informational, logical, computing and systems.

In applied problems, DILOS can be utilized in various versions. One version is the SPORT system, in which linguistic, information and a simplified logic processor are used, as well as the DILOS system data base. Furthermore, the system consists of a control processor to control information and logic processors.

In contrast to classic IPS, this systems version provides reception of request texts in natural language.

[102]

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SECTOR ARCHIVES OF ALGORITHMS AND PROGRAMS

Moscow AVTOMATIZIROVANNYYE SISTEMY UPRAVLENIYA. EKSPRESS-INFORMATSIYA (Automated Control Systems. Express Information) in Russian, Issue 6, 1979 signed to press 25 May 79 pp 4-6, 6-8, 10-11, 13

[Annotation, excerpts and table of contents from collection edited by R. S. Molchadskaya, 4,560 copies, 13 pages]

[Text] This issue of Express-information contains the annotation of 28 algorithms and programs, developed by the organizations (enterprises) of the sector and included after approval and review by the staff of the sector archives of algorithms and programs (OFAP) in 1978.

The algorithms and programs were designed for the solution of various scientific-technical and economic problems, which are included in the system of software for the YeS (Unified System) M-5000 and M-6000 computers.

This issue was compiled in accordance with the "Classifier of the state archives of algorithms and programs." The material may be examined in the NPO (Scientific Production Association) "Tzentroprogrammsistem" of the city of Kalinin. L. T. Sozinova was responsible for the issue.

[Excerpts]

Programs for Processing Files and Information Searches

1. A program for sorting files for use in the M-6000 ASVT-M (Modular system of computer technology) computer complexes.

This program was designed for the sorting of files of the second and third types in systems with DOS RV (Real Time Disk Operating System) and SUF (expansion unknown), ASVT-M. The program disk resident in real time, works with the subroutine OTSRT.

The program is written in the MNEMKOD language for the M-6000.

The input parameters, essential for the program's operation, are transmitted by means of a calling sequence.

The length of the program is 894 commands, of the subroutine 217 commands.

Time spent on a control problem with a file with 18 records with sorting according to three key words in two variants (descending and ascending) was about 0.5 min.

Number of pages is 45. Author: R. I. Khakimzyanova, TsNIIKA (Central Order of the Labor Red Banner Scientific Research Institute of Complex Automation), Moscow

2. The generation of a file on an input list.

This program was designed for the generation of a file on the input list of the products of the file, containing data grouped in a range span of the variants of the use of the product. The result of the operation of the program is a file on magnetic tape, in the records of which is a key and the carried over properties of the source files. The records of the file are blocked, and of a fixed length. The file has the standard marks.

The program words under the control of the DOS YeS (Unified System disk operating system) in assembly language. The length of the program is 200 commands.

The operating time of the program for the control example was 10 minutes.

The number of pages is 41.
Author: M. Sh. Galiakhmetova, GNIPI VT (possibly Computer Center of State Scientific-Research Pedagogic Institute), Kazan'

3. The generation of codes of working centers in a file of operational labor standards based on a file of correspondence between codes for equipment and codes of working centers. This program is designed for the generation of codes for working centers in a file of operational labor norms on the basis of a file of correspondence between codes for equipment and codes for working centers. The program has the capacity to dump to magnetic tape followed by printout on an Alphanumeric printer, the records of the file of operational labor standards, for which there is no code for working centers in the file containing the correspondence between equipment codes and codes of working centers.

The program is written in assembly language, and works under the control of the DOS/YeS. The length of the program is 540 commands. The solution time for the control examples was 10 minutes.

The number of pages is 32.
Author: E. Kh. Khodzhayev, GNIPI VT, Kazan', 1978

4. The inclusion in a main subject file (GP) of the numbers of the final variant for executing a product in a range.

In a number of enterprises data on labor and material expenditures of objects are identical for groups of objects and are given once for a range of codes.

This program is designed for the generation and maintenance of an additional user's field (or fields) in the GP file, indicating the value of the code for the object from the range, which relates to the corresponding address object with the SI (current awareness information) and PTN (expansion unknown) files.

The program works under the control of the DOS/YeS, using the SIOD-1 macrocommands in assembly language.

The length of the program is 449 commands. The time spent on the control example was 10 minutes.

The number of pages is 33.
Author: N. B. Bedrina, GNIPI VT, Kazan', 1978

7. Print-out of files of a data base.

The program "Print-out of files of a data base" is designed for printing on an alphanumeric printer of data base (BD) files in a form given by the user on parameter cards.

The program works under the control of the DOS/YeS using SIOD-1 macrocommands. It is written in assembly language. The length of the program is 710 commands. The time spent on a control example was 5 minutes.

The number of pages is 38.
Author: V. V. Surova, GNIPI VT, Kazan'. 1978

Problems in Economic Calculations, Optimal Programming, Planning and Accounting

I. Accounting of expenditure of tools (by a tool dispensing stock room [IRK]) per month.

Accounting for the presence of a tool in the tool dispensing stock rooms of workshops is automated. For a solution of the problem an NSI (Reference Information on Standards) file "Reference book of prices for tools" is used.

The problem assures timely distribution concerning the expenditure and actual remainder of tools by the IRK of workshops.

The length of the program is 1250 statements in the source language.

The time spent on the control example was 20 minutes.

The number of pages is 84.
Authors: T. G. Kolosh, I. B. Boroditskaya, L. M. Yagur and M. T. Volod'ko, TsNIITU (Central Scientific-Research and Planning-Technological Institute for the Organization and Technology of Control), Minsk, 1978

II. The "Calendar" Program

The program is used in applied program packages directed to the solution of problems in scheduling and performs the following functions: adjustment to the length of the working week; transformation of relative coordinates on the axis of time into calendar date; transformation of the calendar date into coordinate; determination of the number of working days in a given calendar period.

For convenience of the users the "Calendar" program allows several modifications of these functions.

The program was developed in the algorithmic PL/1 language for the OS (operating system) YeS and is in the form of a procedure with several inputs.

The calculation takes 49 pages.

The length of the program in object code is 13,337 bytes.

The time to solution of the control example on the YeS-1040 was 1 minute 14 seconds.

Author: A. D. Antonenko, MNIPI SPU (Moscow Scientific-Research and Design Institute for Programmed Evaluation and Review Technique), Moscow, 1978

Programs for Control of Production Processes and Administrative Control

1. Algorithms and programs for the task of "Analysis of the use of work time by workers" (by enterprise, workshop per month).

The results of the solution of the problem are designed for timely revelation of losses of working time by workers and discovery of production reserves due to better use of working time. In the process of solution the coefficient of use of working time and the influence of liquidation of above plan loss of time on output of goods production are determined.

The program is written in COBOL for the YeS-1020.

The time to solve the problem is 40 minutes.

The length of output along with the control example is 122 pages.

Authors: Z. Ye. Podvin, A. A. Ignatovich, L. K. Vasil'yeva et al, TsNIITU (Central Scientific Research Institute and Planning-Technological Institute for the Organization and Technology of Control), Minsk

2. The package of applied programs "Prediction of demand for building materials"

Designed for predicting the demand of construction trusts for material resources in the compilation of the yearly requisition of the trusts. The results of the solution can also be used in the compilation of yearly requisitions and distributions of funds for construction materials.

The program is written in PL/1 for the YeS-1030.

The size of the package is 1192 statements. The time to solve the problem is 2 seconds for 1 construction material.

Translation time is 40 minutes.

Authors: A. V. Bespalov, N. N. Zalyapina, S. Yu. Obraztsov, T. V. Portnova, I. G. Shepelev (Chelyabinsk Polytechnical Institute imeni Leninskiy komosomol, 1978)

3. DOS/M-5100. Version, oriented to two machine operation.

The material contains the description of algorithms and programs of the DOS for a two machine complex, where one machine is a model M-5100 and the second the PVK (Punchcard Computer complex) M-5000/M-5010, M-5100 or any of the models of the YeS computer. Along with the description of the algorithms for the use of Magnetic Disk storage as a general external memory in the two machine complex.

The assembler language, the general size of the control programs of the DOS for the two machine complex in absolute format is 3500 bytes.

The number of pages is 103.
Authors: V. P. Gruzhas, R. A. Keris, V. A. Kil'dishyus (SKB (Special Design Bureau) VM (Computer), Vilnyus, 1978

4. Disk operating system M-5100 Control Programs

The material contains a description of the DOS M-5100 control programs, making it possible to automate the process of compiling and executing working programs on the machine. The control programs form the basis of the operating system. They fulfill the following functions:

preparation of the operating system for functioning (programs for Initial Loading);

reception of tasks and preparation of them for execution (programs for Management of jobs);

control of the course of execution of programs (programs for the Supervisor and Call);

control of procedures of Input and Output (programs for the Supervisor and Job management).

The general size of the control programs is 59,910 bytes.

The material includes a detailed description of algorithms of the control programs; a graphic representation and the texts of the programs in assembly language.

The length of the material is 466 pages.
Authors: G. I. Labetskite, V. G. Kil'dishyus et al, SKM VM, Vil'nyus.
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ALGORITHMS AND PROGRAMS

Moscow ALGORITMY I PROGRAMMY in Russian No 2, 1980

[Selected Items from ALGORITMY I PROGRAMMY. BIBLIOGRAFICHESKAYA INFORMATSIYA (Algorithms and Programs. Bibliographic Information), a publication of the USSR State Public Scientific and Technical Library]

[Excerpts] 429. Farkhadov, T. Application of PREFOR Formula Language. ALGORITMY (Algorithms), Uzbek SSR Academy of Sciences. IK s VTs [not further identified], 1979, No. 38, pp. 16-31. References: 7.

The PREFOR language consists of symbolic information, represented as a line in ALGOL language. Algorithms of analytical transformations of symbolic information are described and a syntactical determination of base elements is given.

430. Dunayev, V. S. "Sistema Avtomatizatsii Mikroprogrammirovaniya SAMP" (The SAMP Microprogramming Automation System), Dimitrovgrad, 1979, 16 pages (Preprint/Scientific Research Institute of Atomic Reactors), No. 40 (399). References: 10.

The design principles of the system are quite general for a large class of microprogramming bases. A SAMP, oriented toward the EKVM microprogramming base of the 15VSM-5 computer is described. The programs of the system are written in ALGOL-GDR language.

431. Yakubov, A. R. A Program of a "Weight" Algorithm for Solving a Boolean Programming Problem. ALGORITMY, Uzbek SSR Academy of Sciences. IK s VTs, 1979, No. 38, pp. 64-69. References: 3.

An ALGOL program for solving problems of integral linear programming with Boolean variables is described.

439. Romanov, V. S. Organization of Mathematics and Software of Automated System for Solving Problems of Land Development Evaluation. "Sovremennyye Metody Obrabotki i Interpretatsii Geofizicheskikh Materialov" (Modern Methods of Processing and Interpretation of Geophysical Materials),

Kazak Scientific Research Institute of Natural Resources, Alma-Ata, 1979, pp. 76-85.

The basic principles and organization of software in ALGOL language for solving geological problems are described. A feature of software is that it is independent of the significance of geologic problems and of the structure of the data. An operational subsystem runs the programs sequentially without the client's intervention.

441. Fedorov, G. M., Avdyukhina, T. M. Weight Planning of Aircraft Landing Gear Structures by Computer Calculation of Their Base Parts. TEMAT. SB. NAUCH. TR./MAI (Thematic Symposium of Scientific Works/Moscow Aviation Institute imeni Sergo Ordzhonikidze), 1979, No. 478, VOPR. PROYEKTIROVANIYA I KONSTRUIROVANIYA SAMOLETOV (Problems of the Planning and Design of Aircraft), pp. 33-44. References: 2.

An ALGOL program for calculating the longitudinal cross section of a base element is described. An example of the calculation of the shock absorber cylinder of the landing gear of the IL-62 airplane is presented.

442. Shamayev, V. G. A Method of Analyzing Thermistors. SOOBSHCH./GOS. ASTRONOM. IN-T (Reports/State Astronomy Institute), 1979, No. 211-212, pp. 15-24. References: 4.

The precision of astronomy depends on a number of factors, one of which is the change of temperature in and outside of the observation pavilion. Pairs of thermistors are used for measuring temperature differences. Thermistor pairs are selected with the aid of an ALGOL program that utilizes the least squares procedure.

444. "Interpretatsiya Dannykh Vysokotochnoy Gravirazvedki na Nestrukturnykh Mestorozhdeniyakh Nefti i Gaza" (Interpretation of Precision Gravimetric Prospecting Data on Unstructured Oil and Gas Deposits), Ye. A. Mudretsova, A. S. Varlamov, V. G. Filatov, G. M. Komarova, Moscow, Nedra, 1979, 196 pages. References: 95.

Programs for processing and interpreting the results of the application of precision gravimetric photography for searching for oil and gas deposits of the lithologic-stratigraphic type in Krasnodarskiy kray and deposits confined to shelves in Bashkirskaya ASSR and Uzbek SSR are presented. New methodological elements on the determination of the density of intermediate rocks and analysis of the influence of local relief and geologic reduction on the results of surface and drill hole gravimetric measurements are described.

445. Realization in Computer of Algorithms for Processing Experimental Data in Problems of Detection of Anomalies on Earth's Surface. N. A. Armand, A. Ye. Basharinov, B. S. Fleyshman, et al, "Voprosy Matematicheskogo Modelirovaniya" (Problems of Mathematical Modeling), USSR

Academy of Sciences, Institute of Radio Engineering and Electronics, Moscow, 1979, pp. 235-270. References: 13.

Programs for the Mir-2 computer for selecting one of two hypotheses for normally distributed random variables are described: FORTRAN -- a recognition program without a priori information about the parameters and character of distributions; for M-4030: POROG programs for determining threshold statistics; anomaly detection RANGV; KIIV for statistical processing of arrays of input numbers, represented on PL in duooctal code; OUTMIR (A,N) for display of prime numbers from an array of integers on PL in information form of Mir-2; INRMIR (B,N,K,L) for input of array of integers from PL in Mir-2 code and for converting them to M-4030 code; in ALGOL and ALMIR languages, a program for computing the characteristics of surface spottiness.

447. Bukatova, I. L., Sharov, A. M. Realization in Computer of Algorithms of Evolutional Modeling, "Voprosy Matematicheskogo Modelirovaniya," USSR Academy of Sciences, Institute of Radio Engineering and Electronics, Moscow, 1979, pp. 142-165. References: 5.

The EPA and ERA evolutional algorithms for the BESM-4 computer are described. The first program operates in the IS-2 system and predicts the next symbol of a sequence; the second, written in ALGOL for an α-translator, recognizes patterns under continuously changing conditions of the description of subjects -- with changes of the characteristics of noises and of signal measurement conditions.

453. Kokoreva, L. V. Structural Properties of Network Model of Managerial Decision Making, VOPR. TEORII I POSTROYENIYA ASU (Problems of Theory and Design of ASU), MIFI [Moscow Engineering Physics Institute], 1979, No. 3, pp. 134-138. References: 4.

A PPP [Applied program package], recommended for incorporation in PO [software] ASU NII [automated control system of Scientific-Research Institute] is described. Eighteen modules of the package are written in YaSK and 20 in KOBOL. The total volume of the package is 43,500 instructions.

456. Abramov, I. P. Coding of Internal States of Asynchronous Automaton, ALGORITMY RESHENIYA ZADACH DISKRET. MATEMATIKI (Algorithms for Solving Digital Problems), 1979, No. 1, pp. 61-84. References: 8.

Programs in LYaPAS-M language for coding the internal states and for determining the structural functions of an asynchronous automaton, run in the SINTEZ-78 logic planning subsystem, are presented.

457. Bibilo, P. N. Algorithms for Defining Ternary Matrix, VT v MASHINOSTROYENII: NAUCH.-TEKHN. SB. (Computer Engineering in Machine-Building: Scientific-Technical Symposium), BSSR Academy of Sciences, ITK, 1979, No. 1, pp. 118-121. References: 4.

458. Vasilenok, V. K. Input and Output of Data in Dialog System for Logic Synthesis of Digital Systems. TEORIYA I METODY AVTOMATIZATSII PROYEKTIROVANIYA: NAUCH.-TEKHN. SB (Theory and Methods of Automated Planning: Scientific-Technical Symposium), BSSR Academy of Sciences, Institute of Technical Cybernetics, 1979, No 2, pp 132-138. References: 6.

A problem of the representation of data, on which a designer performs operations, is solved with programs in LYaPAS-M language. The corresponding dialog language for input and output of data by computer control is described.

459. Kiriyenko, N. A. Exchange Operations in LYaPAS-M Programming System. TEORIYA I METODY AVTOMATIZATSII PROYEKTIROVANIYA: NAUCH.-TEKHN. SB., BSSR Academy of Sciences, Institute of Technical Cybernetics, 1979, No 2, pp 121-126. References: 3.

A method that is particularly effective in dialog systems, reducing the volume of a program and its translation time, is described. Exchange programs are written in YaSK of the Minsk-32 computer and occupy about 3,000 cells of internal memory. The unit that translates exchange operations is written in LYaPAS-M language.

460. Toropov, N. R. Organization of Interaction of Monitors in DISMO, VT V MASHINOSTROYENII: NAUCH.-TEKHN. SB., BSSR Academy of Sciences, ITK, 1979, No 1, pp 129-135. References: 1.

The mechanism of the interaction of personal monitors in LYaPAS-M language, in a multilanguage dialog group access system, is described and methods of maintaining the process of dialog with subscribers in the intermediate states are explained.

477. "Sistema Programmno-Matematicheskogo Obespecheniya dlya Resheniya Geologicheskikh Zadach Metodami Mnogomernoy Statistiki na YeS EVM (CMO GEOCYBER)" (Software System for Solving Geologic Problems by Multidimensional Statistics Methods Using Unified Series Computers (CMO GEOCYBER)), Moscow, 1979, 64 pages (Algorithms and Programs/USSR Academy of Sciences, VIEMS [All-Union Scientific Research Institute of Economics of Mineral Raw Materials and Geological Exploration], GIVTs [Main Information-Computing Station] ASU--Geology, OFAP [not further identified] Geology, No 4 (30). References: 18.

A general description of the system and of its individual parts--input problem-oriented client language (GEPROL) and package of general- and special-purpose processing subroutines--is presented. The operation of the system is examined by example of the GEOSKOP subroutine package. Programs of the most important procedures in PL/1 language are presented.

480. Zayler, V. P., Babushkin, A. V. The Structure and Design Principles of the General Information Data Base for Comprehensive Model of the Functioning of Energy Systems and of the Development of the OASU [Sector

automated control system] "Energiya" Sector, "Algoritmy Rascheta Optimal'nogo Rezhima Elektricheskikh Setey i Sistem" (Algorithms for Calculating Optimum Mode of Electric Networks and Systems), MSSR Academy of Sciences, Department of Energy Cybernetics, Kishinev, 1979, pp. 63-69. References: 2.

A method of developing the data base of OASU "Energiya" that shortens the development time to the maximum extent without a sacrifice of any of its characteristics, is described. The PL/1 programming language is used.

482. Yemel'yanov, N. Ye., Titov, V. K., Chistyakov, V. V. "Programmirovaniye na Yazyke RPG" (Programming in RPG Language), Moscow, 1979, 64 pages (MO Systems/Institute of Control Problems, No. 11). References: 3.

The basic services offered to clients by the RPG-translator ICL 4-70 are described. The differences between RPG-translators in the OS of the ICL 4-70 and Yes EVM [Unified series computers] are explained.

489. Belyavskiy, A. A., Bagdasaryan, A. S. Automated Programming of EM-519 Microphoto Typesetter. Program Generator in Input Language of Machine, "Voprosy Matematicheskogo Modelirovaniya" (Problems of Mathematical Modeling), USSR Academy of Sciences, Institute of Radio Engineering and Electronics, Moscow, 1979, pp. 380-383. References: 1.

491. Ivanov, Yu. N. "O Sovmeshchenii Lokal'nykh Peremennykh v Programmakh na FORTRANe" (On Combining Local Variables in FORTRAN Program), Serpukhov, 1979, 12 pages (Preprint/IFVE, No. OEA 79-109). References: 8.

A method of distributing memory for local variables of FORTRAN programs that meet certain requirements is described. The local variables of certain subroutines are combined, which increases the computer memory utilization efficiency.

492. Kolchin, A. D., Fedoseyev, Yu. N. Reliability and Proof of Correctness of Programs, VOPR. TEORII I POSTROYENIYA ASU (Problems in Theory and Design of ASU), MIFI, 1979, No. 3, pp. 109-114. References: 11.

A procedure for proving the correctness of programs of a rather arbitrary form of correction of a package of standard subroutines for a translator from the FORTRAN language is described.

493. Korovin, A. V., Udalov, V. N. Selection of Effective Method of Operation of Multiprocessor Computer System in Consideration of Reliability and Algorithm Characteristics, VOPR. TEORII I POSTROYENIYE ASU, MIFI, 1979, No. 3, pp. 18-24. References: 3.

Five possible models of the organization of the functioning of computer systems, consisting of two groups of processors, are described. An automated planning system using FORTRAN language for listing these models is

explained. The system takes about 5K bytes, and the time it takes to find the best model is about 5 s.

494. Orlov, Yu. N. "Proverka s Primeneniyem EVM Printsipial'nykh Skhem, Razrabotannykh na Tsifrovykh Integral'nykh Mikroskhemakh i Sostavleniye Testov dlya Otladki Gotovykh Uzlov" (Computer Checking of Schematic Diagrams of Digital Integrated Microcircuits and Writing of Tests for Debugging Finished Units), Moscow, 1979, 18 pages + appendix (18 pages), Preprint/USSR Academy of Sciences, Institute of Radio Engineering and Electronics, No. 9 (265).

Two FORTRAN programs are described: one for modeling the operation of microcircuits (volume $\geq$2,000 operators), and one for checking circuits in terms of the load capacity of the outputs of microcircuits. Individual parts of the program are written for the SM-3 computer in a macroassembler, which reduces the time and volume of programs.

497. Adamenko, G. M., Yedinovich, A. A., Naumovich, M. S. "Sistema Generatsii Mashinnykh Algoritmov dlya Resheniya Zadach Bezuslovnoy Minimizatsii (SIGMA)" (Computer Algorithm Generation System for Solving Unconditional Minimization Problems (SIGMA)), Minsk, 1979, 35 pages (Preprint/ BSSR Academy of Sciences, Institute of Mathematics, No. 15 (71)). References: 11.

The system is written in FORTRAN and Assembler languages and is stored in a library in the form of entity modules. The information used for generation is extracted from a questionnaire (the input language of the system). Compositions of minimization algorithms may be generated. Examples of the utilization of the system are described.

502. Kukebayev, A. M. Standard Programs for Solving Nonlinear Equation Systems by Gradient Method, "Voprosy Matematicheskogo Modelirovaniya," USSR Academy of Sciences, Institute of Radio Engineering and Electronics, Moscow, 1979, pp. 319-322. References: 1.

503. Lunin, V. Yu. "Kompleks Programm 'Bystroye Preobrazovaniye Fur'yye:' Programmnoye Obespecheniye Strukturnykh Issledovaniy" (System of "Fast Fourier Transform" Programs: Software for Structural Analyses), Pushchino, 1979, 45 pages (Materials on MO EVM/USSR Academy of Sciences, Scientific Center of Biological Studies, No. 3). References: 5.

The system includes FORTRAN programs for three-dimensional digital transformation in problems of x-ray diffraction analysis and for one-dimensional digital Fourier transform in a broad class of problems.

530. Badalyan, S. G., Glagolev, V. V., Ivanov, V. G. "Paket Programm dlya Ekspress-Analiza Rezul'tatov Geometricheskoy Rekonstruktsii i Kinematicheskoy Identifikatsii Sobytiy" (Program Package for Fast Analysis of

Results of Geometric Reconstruction and Kinematic Identification of Events), Dubna, 1979, 13 pages (Reports/OIYaI [Joint Institute of Nuclear Research]; No. R10-12606). References: 19.

531. Vilkova, L. P., Nefedov, Ye. I., Fiaklovskiy, A. T. Program for Calculating Eigen Numbers of Higher Nonradiating Wave Types of Microstrip Wave Guide, ELEKTRON. TEKHNIKA. SER. 1. ELEKTRON. SVCH (Electronic Technology. Series 1. SHF Electronics), 1979, No. 7, pp. 118-119. References: 3.

A FORTRAN program for calculating asymmetric waves without diffractive losses is described. The time for calculating one version is 3 s.

532. Druzhinin, A. V., Nikol'skiy, V. V. Program for Calculating Active Wave Propagation Constants of Different Types of Strip and Slot Lines, ELEKTRON. SVCH, 1979, No 7, pp 122-123. References: 3.

535. Zhurikhin, Yu. P. Automated Planning of Exterior and Interior Arrangement of Passenger Liners and Cargo Planes in Preliminary Design Stage, "Temat. Sb. Nauch. Tr./MAI" (Thematic Symposium of Scientific Works/ MAI), 1979, No. 478, Problems of Aircraft Planning and Design, pp. 27-33.

A package of FORTRAN programs for automated planning, which is a part of an automated system of preliminary planning and outlining of airplanes, produces on a graphical display or plotter a general image and layout plan of an airplane. The average time for calculating one layout is 22 s.

537. Korneychuk, A. A., Litvinenko, O. K. "Algoritmy Obrabotki Gravimetricheskikh Dannykh i Ikh Realizatsiya na FORTRANe" (Algorithm for Processing Gravimetric Data and Their Implementation in FORTRAN), Dubna, 1979, 11 pages (Reports/OIYaI, No. 10-12534). References: 16.

A system of programs in FORTRAN for processing gravimetric field measurement data for analyzing the structure of the earth's core and for mineral prospecting in consideration of the influence of a number of systematic instrument errors, is described. Repeated observations are averaged to reduce the influence of random errors, and absolute values of gravity forces relative to measurement data are found by solving an overdetermined linear algebraic equation system.

544. "Skaniruyushcheye Lazernoye Zerkalo s Programmnym Upravleniyem ot EVM PDP 11/04" (Scanning Laser Mirror, Programmed by PDP 11/04 Computer), T. B. Koreshkova, N. V. Pletnev, Yu. V. Senatskiy, et al, Moscow, 1979, 19 pages plus appendix (17 pages). (Preprint/USSR Academy of Sciences, Physics Institute, No. 64). References: 11.

A FORTRAN program for controlling a mirror in the laser beam scanning mode for several kinds of trajectories is described.

545. Khutornoy, N. V. "Programma Redaktirovaniya Pechatnykh Skhem" (Program for Editing Printed Circuits), Dubna. 1979, 10 pages (Reports/ OIYaI, No. R11-12530). References: 5.

A FORTRAN program for editing the wiring circuits of one- and two-layer printed circuit boards is described. The total program volume is about 450 operators, and memory volume is about 73,000 words. The computing time with a BESM-6 computer is 2-3 min, and with the CDC-6500 it is 30-40 s for average circuit boards.

559. Kotov, Yu. B., "Biblioteka Programm Arkhiva EDA" (The Program Library of the EDA [not further identified] Archives), Moscow, 1979, 32 pages (Preprint/USSR Academy of Sciences, IPM, No. 163). References: 7.

The EDA archives is a package processing system for experimental data, consisting of a library of 300 subprograms, used for internal needs of clients and for servicing the archives. The information on certain new capabilities of the archives is presented.

560. Matyugov, S. S., Yakovleva, G. D. Computer Determination of Parameters of the Atmosphere of Venus on the Basis of Amplitude Data of Radio Sounding Experiments from "Venera-9" and "Venera-10" Space Probes, "Voprosy Matematicheskogo Modelirovaniya" (Problems of Mathematical Modeling), USSR Academy of Sciences, Institute of Radio Engineering and Electronics, Moscow, 1979, pp. 199-213. References: 3.

A FORTRAN program for processing experimental data and for solving the inverse problem of determining the parameters of the atmosphere of Venus on the basis of radio wave amplitude measurements is described.

561. "Sistema Obrabotki Eksperimental'nykh Dannykh na Ustanovke "Lepton" (System for Processing Experimental Data in "Lepton" Machine), R. I. Dzhelyadin, A. M. Zaytsev, V. P. Kubarovskiy, et al, Serpukhov, 1979, 18 pages (Preprint/IFVE: No. OEF 79-114, SERP-E-134). References: 9.

The basic stages and software system for processing experiments in the "Lepton" machine are described. The programs are written basically in FORTRAN, and some subprograms are written in PLAN-4 language. Processing speed is about 130-350 ms/event, depending on the complexity.

563. Aksenov, V. V., Voronin, Yu. A., Khon, B. I. "Paket Prikladnykh Programm Podsistemy 'Operativno-Kalendarnoye Planirovaniye' (Formalizatsiya Upravleniya NIR i OKR)" (Applied Program Package of "Operational Calendar Planning" Subsystem (Formalization of Control of NIR [Scientific research work] and OKR [Experimental design work])), Novosibirsk, 1979, 28 pages (Preprint/Siberian Department of the USSR Academy of Sciences, VTs; No. 192). References: 6.

A package of programs is described for revealing the outlines and dead ends of a network schedule, for drawing, correcting and pruning networks on MD,

for generating and printing out monthly plans, etc. A FORTRAN program for formatting disks is described. The volume of MOZU [Magnetic internal storage] is 256K bytes. The calculation time of a test sample is 40 min for all programs. The calculation time depends on the number of jobs in the network model and the number of models in the network schedule library.

565. Volovik, A. I., Gerasimov, A. S., Nemirovskaya, S. A. "Optimizatsionnaya Programma Rascheta Obrazovaniya Izotopov v Yadernom Reaktore" (Optimization Program for Calculating Isotope Production in Nuclear Reactor), Moscow, 1979, 29 pages (Preprint/ITEF; No. 110). References: 8.

The ISOTOP FORTRAN program for optimizing the production of isotopes in a nuclear reactor is described. The program permits examination of up to 15 isotopes. The production of plutonium-238 from neptunium-237 is examined as an example.

566. Voronin, Yu. A., Titov, A. A. "Paket Prikladnykh Programm Podsistemy 'Perspektivnoye Planirovaniye Deyatel'nosti Organizatsii' (Formalizatsiya Upravleniya NIR i OKR)" (A Package of Applied Programs of the "Future Planning of Organizational Activity" Subsystem (Formalization of Control of NIR and OKR)), Novosibirsk, 1979, 32 pages (Preprint/Siberian Department of the USSR Academy of Sciences, VTs [Computer center], No. 190). References: 3.

A FORTRAN program package for calculating and drafting future thematic plans of NII [Scientific-research institute], KB [Design office] and scientific-industrial associations, is described. The texts of several programs in FORTRAN language are presented in the form of a FFORTRAN translator listing.

570. "Paket Prikladnykh Programm Podsistemy 'Godovoye Planirovaniye Deyatel'nosti Organizatsii' (Formalizatsiya Upravleniya NIR i OKR)" (Package of Applied Programs of the "Annual Planning of Organizational Activity" Subsystem (Formalization of Control of NIR and OKR)), V. V. Aksenov, Yu. A. Voronin, G. F. Moskovets, A. A. Titov, Novosibirsk, 1979, 25 pages (Preprint/Siberian Department of the USSR Academy of Sciences, VTs, No. 191). References: 3.

A package of FORTRAN programs for calculating annual thematic plans of subdivisions and scientific-research organizations as a whole, and for drafting expanded calendar plans and calculation of estimating costs by subject matter, is described.

571. "Paket Prikladnykh Programm Podsistemy 'Formirovaniye i Vedeniye Fonda Normativno-Spravochnoy Informatsii' (Formalizatsiya Upravleniya NIR i OKR)" (Package of Applied Program of "Formation and Maintenance of Reference Data Bank" Subsystem (Formalization of Control of NIR and OKR)), V. V. Aksenov, Yu. A. Voronin, N. M. Podgornaya, et al, Novosobirsk, 1979,

27 pages (Preprint/Siberian Department of the USSR Academy of Sciences, VTs, No. 189). References: 3.

An applied program package in FORTRAN language for constructing types of models on the basis of job classifiers, containing a group of typical elementary jobs with standard cost, time and labor indices, is described. Programs are written in the form of a FFORTRAN translator listing.

572. Aksenov, V. V., Voronin, Yu. A. "Formalizatsiya Upravleniya NIR i OKR (Obzor)" (Formalization of Control of NIR and OKR (Survey)), Novosibirsk, 1979, 17 pages (Preprint/Siberian Department of the USSR Academy of Sciences, VTs, No. 188).

Information on an applied program package, written in FORTRAN language, is presented. Memory volume is 256K bytes.

575. Mikhaylov, D. V., Ostashok, S. F. On One Approach to Forecasting of Technical-Economic Indices of Adoption of New Technology, VOPR. TEORII I POSTROYENIYA ASU (Problems of Theory and Design of ASU), MIFI, 1979, No. 3, pp. 128-134. References: 4.

The construction of a two-level combined model of forecasting on the basis of the solution of classification, identification and forecast analysis problems of entities in FORTRAN language, is explained. The forecasting error for an array of 40 new products is $\leq$15%.

576. Mkrtchyan, F. A. A Pattern Recognition Program Utilizing Discriminant Analysis, "Voprosy Matematicheskogo Modelirovaniya" (Problems of Mathematical Modeling), USSR Academy of Sciences, Institute of Radio Engineering and Electronics, Moscow, 1979, pp. 312-318. References: 2.

577. Computer Implementation of a Global Model of the Biosphere, N. N. Moiseyev, Yu. M. Svirezhev, V. F. Krapivin, et al, "Voprosy Matematicheskogo Modelirovaniya," USSR Academy of Sciences, Institute of Radio Engineering and Electronics, Moscow, 1979, pp. 333-369. References: 8.

A FORTRAN program for calculating and for experimenting on the biosphere is presented.

602. Bronshteyn, O. I., Yakobson, G. R. Simulation and Calculation of Closed Queuing Networks, "Metody i Struktury Sistem Teletrafika" (Methods and Structure of Remote Traffic Control Systems), USSR Academy of Sciences, Institute of Data Transmission Problems, Moscow, 1979, pp. 58-63. References: 3.

An algorithm and a typical SEZAM program (NEtwork CLOsed) in a type GPSS simulation language, are developed for analyzing general networks. The program simulates large networks (up to 1,000 requests, up to 300 stations and up to 100 instruments per station -- of the order of thousands of priority classes of requests). The simulation time is a few minutes.

606. Dedkov, A. I., Revenko, V. L., Shvab, N. D. "Matematicheskiye Modeli i Metody Resheniya Zadach Vybora Struktury Proizvodstvennykh Podrazdeleniy" (Mathematical Models and Methods of Solving Problems of Selection of the Structure of Industrial Subdivisions), Kiev, 1979, 35 pages (Preprint/USSR Academy of Sciences, IK, No. 79-21). References: 18.

A program in NEDIS language for simulating a problem of the selection of the organizational structure of a machine-building shop of a ship-building enterprise on the basis of the classification and standardization of the product nomenclature, is described.

638. Baluka, G., Salamatin, I. M., Khrykin, A. S. "Programma-Bibliotekar' dlya Mashin, Programmno-Sovmestimykh s EVM M-400" (A Program Librarian for Machines That Are Program-Compatible with the M-400 Computer), Dubna, 1979, 13 pages (Reports/OIYaI, No. 10-12546). References: 4.

A program librarian is described for maintaining and editing libraries of programs, loaned out in the dynamic memory distribution mode, and written in MACRO-11 language. The library is a file in an external storage system.

645. Galaktionov, V. V., Mazepa, Ye. Yu. "Initsializatsiya i Avariynoye Vosstanovleniye Sistemy Kontsentratora Terminalov dlya BESM-6" (Initialization and Emergency Repair of Terminal Concentrator System for BESM-6), Dubna, 1979, 7 pages (Reports/OIYaI, No. R11-12492). References: 2.

Programs for the initial adjustment and emergency restoration of a public BESM-6 system with a terminal concentrator based on the YeS-1010 computer, are described.

659. Alekseyev, N. N. "Interpretatsionnaya Sistema NODAL dlya EVM YeS-1010" (The NODAL Interpretation System for the YeS-1010 Computer), Moscow, 1979, 32 pages (Preprint/ITEF, No. 118). References: 6.

The basic rules of programming in NODAL and the structure of a system operating under the control of the DOSRM OS of a proton synchrotron parameter control and testing system, are described.

664. Likhacheva, G. N. "Razrabotka Operatsionnykh Sistem" (Development of On-Line Systems), Part 3, Textbook, Moscow, 1979, 113 pages, MESI. References: 40.

Given in the book are control tables and the basic algorithms of such components of OS packages as task control, program preparation system, logic input-output control system, systems file access, and principles of the planning of service programs. The deficiencies of OS of the package type and the prospects of development of job and memory control systems are examined. The main memory volume in the binary number system is equal to the number of pages. Page length varies in different systems (in the OS of YeS computers and IBM-360 it is 2,048 bytes, and in the ICL system Jay it is 512 bytes).

665. Orlov, S. I., Uvarova, T. G., Fal'ko, S. V. "Sistema Upravleniya Pamyat'yu Bol'shoy Yemkosti" (A Large-Capacity Memory Control System), Preprint, Vladivostok, 1979, 17 pages, USSR Academy of Sciences, Far East Scientific-Research Center, Institute of Automation and Control Processes. References: 9.

Systems for organizing large-capacity memory -- a programmed virtual memory system (SVP) and methods of access to VP [virtual memory] -- direct, associative and library, are examined. SVP contains external memory control systems -- type of pages and provides three levels of physical memory control: flexible, rigid and a silence strategy. The associative method provides access to information by key and provides for the development of a series of dictionaries in VP. The volume of a dictionary is virtually unlimited. The retrieval time does not depend on the volume of stored data. The memory control system is designed within the framework of OS YeS. The language for conversing with the system is a set of instructions on the Assembler level.

666. "Paket Prikladnykh Programm 'Obmen Informatsiyey Mezhdu EVM III Pokoleniya i UVK M-6000' (PPP-YeSM): Kratkoye Opisaniye Primeneniya (Applied Program Package "Exchange of Information Between Third-Generation Computer and UVK M-6000" (PPP-YeSM): Brief Description of Application), USSR Ministry of Instrument Engineering, Automation and Control Systems, Soyuzsistemprom, Scientific-Industrial Association "Tsentrprogrammsistem," Kalinin, 1979, 13 pages.

For acquiring the package the reader is referred to department 214 at the following address: 170023, g. Kalinin, ul. Zhdanova, 10, tel.: 4-44-94.

668. "Sistema Generatsii Programm Zagruzki i Aktualizatsii Baz Dannykh, Organizovannykh s Pomoshch'yu SUBD OKA (KOMPAKT)" (System for Generating Charging and Actualization Programs of Data Bases, Organized with the Aid of SUBD OKA (KOMPAKT)), Books 1-5, UkrSSR Academy of Sciences, IK, Kiev, 1979.

Book 1. A General Description, 14 pages. Book 2. Programming Manual, 173 pages. Book 3. Systems Programmer's Handbook, 27 pages. Book 4. Operator's Handbook, 5 pages. Book 5. Description of Test Sample, 46 pages. References: 3.

PPP [Applied program package]-KOMPAKT was developed on the basis of YeS computers with an internal memory capacity $\geq$256K, with separate program generation. The generated programs may include nonstandard operations associated with the processing of data files and bases in PL/1 language.

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694. Norenkov, I. P., Manichev, V. B., Zhuk, D. M. Application of Electric Macromodules of Microcircuits in Design of Electronic Equipment, TR. MVTU (Proceedings of Moscow Higher Technical School imeni N. E. Bauman), 1979, No. 304, Planning of Elements of Computer Assemblies and Systems, No. 4, pp. 89-103. References: 2.

695. "Ob Informatsionno-Poiskovykh Sistemakh, Ispoluzuyemykh na EVM Tipa M-20" (On Information Retrieval Systems Used in Computers of the M-20 Type), USSR Academy of Sciences, IPM, Moscow, 1979, 12 pages.

The SINKHRON information system (based on a card file), an on-line factographic information system (OFIS) and KADR system for servicing card files of the personnel card file type, are examined.

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The ASOM-AM automatic aerial magnetic prospecting data processing system for the Minsk-32 computer is described.

710. Mkrtchyan, F. A. Implementation in Mir-2 Computer of Optimum Algorithm for Teaching Statistical Decision Making for Random Variables with Normal Distribution, "Voprosy Matematicheskogo Modelirovaniya" (Problems of Mathematical Modeling), USSR Academy of Sciences, Institute of Radio Engineering and Electronics, Moscow, 1979, pp. 307-311. References: 1.

713. Dynamic Memory for the SM600 Microprocessor System, Z. Aleksandrova, A. Aleksandrov, I. Sar"ivanov, S. Pishchalov, AVTOMATIKA I IZCHISLIT. TEKHNIKA (Automation and Computer Technology), 1979, Vol. 13, No. 4, pp. 37-42. References: 4.

A dynamic memory for the SM600 microprocessor system is examined. The advantages of the dynamic memory include high density of information and low cost per bit. The way the system performs memory cycles and experience in its utilization with several 8K-byte memory modules connected are discussed.

719. "K Voprosu Ispol'zovaniya Rezhima Dialoga v Sistemakh Matematicheskoy Obrabotki Fil'movoy Informatsii" (On the Utilization of the On-Line Mode in Systems for Mathematical Processing of Filmed Information), S. G. Badalyan,

N. N. Govorun, V. G. Ivanov, et al, Dubna, 1979, 9 pages (Reports/OIYaI, No. R10-12582). References: 10.

On-line programs for organizing and effectively monitoring in all stages the analysis of the results of measurements of photographs, for generating applied programs of the processing system and for teaching clients how to use the CDC-6500 computer, are developed.

723. "ASINIT, Avtomatizirovannaya Sistema Informatsii po Nauke i Tekhnike po Nepublikuyemym Istochnikam" (ASINIT, Automated Scientific and Technological Information System Based on Unpublished Sources), VNTITsentr, Moscow, 1979, 166 pages.

The ASINIT system was developed for the purpose of improving the efficiency of planned, in-progress and completed NIR [Scientific research work] and OKR [Experimental design work] on the basis of on-line and high-quality information support of the processes whereby they are implemented and adopted. The applied software of the system was adopted on the basis of DOS DPS of the GE-435 computer. All subsystems of ASINIT are described.

725. Kalinchenko, P. A. "Programmy Rascheta Dvizheniya Chastits v Uskoritele IFVE" (Programs for Calculating Particle Motion in IFVE Accelerators), Serpukhov, 1979, 27 pages (Preprint/IFVE, No. OMVT-79-103). References: 19.

The RVZ program package integrates particle trajectories to an accuracy of 10^{-6} m through the length of one magnet unit (10.4 m) in 6 s using the ICL-1906A computer. The volume of the RVZ programs is 3,099 cells.

726. "Mikroprotsessornaya Sistema dlya Kalibrovki i Kontrolya Eksperimental'noy Apparatury Ustanovki RISK" (A Microprocessor System for Calibrating and Testing Experimental Equipment of the RISK Installation), K. P. Glasnek, Yu. P. Merekov, K. Pishka, et al, Dubna, 1979, 10 pages (Reports/OIYaI, No. R10-12555). References: 6.

A self-contained system in the KAMAK standard, based on the Intel-8080 microprocessor, consisting of a loop module, several event modules and a smart module, is described.

735. Kuropatkin, N. P. "Matematicheskoye Obespecheniye dlya Nastroyki Sistem KAMAK Kollektivnogo Pol'zovaniya" (Software for Adjusting KAMAK Group Utilization Systems), Leningrad, 1979, 20 pages (Preprint/USSR Academy of Sciences, LIYaF, No. 519. References: 6.

The software was developed for the PDP-11/40 computer with the real-time OS of the RSX-11M and can be used in SM-3 and SM-4 class computers. The required memory is 16K words.

[225-7872]

ON THE COMPILATION OF ONE EXPANSION OF ALGOL

Moscow VESTNIK MOSKOVSKOGO UNIVERSITETA. SERIYA 15. VYCHISLITEL'NAYA MATEMATIKA I KIBERNETIKA in Russian No 1, 1980 pp 67-69 manuscript received 15 Mar 79

[Article by S. A. Mityugova]

[Excerpts] A language that is an expansion of ALGOL, and with which algebraic operations can be done on formulas, derivatives computed and calculations done by the formulas derived, i.e., with which operations characteristic of the solution of many applied problems can be performed, is examined in [1]. An application of this expansion, accomplished in the BESM [High-speed electronic computer]-ALGOL system by the multiple compilation procedure [2], is examined in this article: in the expanded language a program is translated into an algol program, and the compiler is written in ALGOL.

In this approach the compiler tries to replace all "nonalgol" objects (formula variables, formula expressions, etc.) with adequate algol objects.

In addition to a direct compiler (a set of statistical procedures) there is a set of functions which perform algebraic operations on formulas, new standard functions, and functions that predetermine standard ALGOL functions for the case when the argument of a standard function is a formula expression. These functions are described as an array of algol functional procedures with assembly language operators.

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2. Sedankina, G. I., "Multiple Compilation in the ALGOL-BESM System," "Problemy Povysheniya Effektivnosti BESM-6. Materialy Seminara"

(Problems of Improving the Efficiency of BESM-6. Materials of a Seminar), edited by R. I. Aleksandrov, et al, Vil'nyus, 1973.

[224-7872]

7872
CSO: 1863

UDC 681.3.01:519.152

ON ONE ANALYTIC MODEL OF A SELECTIVE USE SYSTEM

Riga AVTOMATIKA I VYCHISLITEL'NAYA TEKHNIKA in Russian No 1, 1980 pp 22-23
manuscript received 1 Sep 78

[Article by S. F. Yashkov and M. Yu. Kitayev]

[Excerpt] In the evaluation of the efficiency of computer systems for collective use (VSKP) and of complexes of terminals, an important role is played by probability models of the VSKP, which are generated through methods in queuing theory. This work investigates an analytic model of the VSKP using a cyclical algorithm of dispatching. This method of allocation of time is widely used in practice. Examples of its use are the JOSS system (30 terminals), the DIPS-0 (20 terminals) and the GE-635 systems with the GECOS (200 users) operating system [1, 2]. A full analysis of a queuing system (SMO), using a dispatching algorithm is possible as a rule with Poisson-exponential assumptions. However, for operating VSKP's, it is more typical to have a situation where the processor works with a relatively small number of terminal devices [4, 5], (i.e., the corresponding SMO has a limited range of sources for incoming flow), and the allocation of service time differs from the exponential. It is possible to approximate the specified process in the study of such systems by considering the limiting case of a cyclical discipline with an unlimitedly small slice, the so-called discipline of processor allocation introduced by Kleinrock.

[223-9285]

9285
CSO: 1863

UDC 681.3.06:51

IDENTIFICATION OF REPEATED SEGMENTS OF MICROPROGRAMS FOR CONTROL AND CORRECTION OF A COMPUTER PROCESS

Riga AVTOMATIKA I VYCHISLITEL'NAYA TEKHNIKA in Russian No 1, 1980 p 78 manuscript received 15 Dec 78

[Article by K. N. Guk]

[Excerpt] A widespread method of correcting a computer process (VP) in cases of transient error is the repetition of the VP operators, during execution of which the error occurred. The repetition may be on the level of an individual microcommand, a segment of a microprogram of a certain operation, individual commands and also segments of programs or the whole program [1].

In the design of devices for the implementation of correcting repetitions, a number of complex problems of hardware and algorithmic nature arise. The problems of hardware, control and diagnostics of the VP have been studied in depth (Cf., e.g. [2, 3]). Some of the most important problems relating to software are selection of the level of repetition--for the reliability required of the results to the solution of the corresponding functional problems; time allowed for the correction of the VP; the possibilities of the control system, and the necessity for retaining information for the repeated execution of a particular fragment of the VP.

It is evident that an essential condition for the correct repetition of a fragment of a computer program is retention of the source information (operands, logical variables, addresses etc.), used in the execution of this fragment. Depending on the type of operator the condition for the retention of source information can either be achieved naturally or a special supplemental operator must be introduced to fix the information necessary for repetition in some region of memory.

In correction by means of repeating a microcommand or segments of microprograms it is frequently not expedient to introduce special operators to fix essential intermediate variables since this requires additional registers and it slows the execution of the microprogram to have to execute the microcommand to enter the intermediate data in these registers and then to load them back into the working registers.

Moreover, the possible transient errors during the entry, storage and loading of the variables is an additional source lowering the reliability of the execution of the microprogram and sometimes requires expenditure on additional devices for the establishment of control.

In this article we consider a means for identifying in microprograms the microcommands and microprogram segments which permit repetition without special storage of information. In the future we will call this type of microcommand and microprogram segment repeatable.

[223-9285]

9285
CSO: 1863

UDC 681.32:519.211.001.57

ON A METHOD OF ANALYTIC MODELING OF NETS OF COMPUTER COMPLEXES

Riga AVTOMATIKA I VYCHISLITEL'NAYA TEKHNIKA in Russian No 1, 1980 p 11
manuscript received 1 Jul 79

[Article by Yu. I. Mitrofanov and V. Kh. Kurbangulov]

[Excerpts] The contemporary degree of development of computer technology, programming and communication technology has made possible the creation and widespread use of a progressive form of organization and use of computing facilities--computer nets, or nets of computer complexes (SVK). SVK's are large and complex systems whose functioning is stochastic in nature. Thus, the solution of problems in systems analysis arising during the design, development and utilization of nets requires both the development and further improvement of methods of studying systems of this type, as well as the generation of software to implement the appropriate methods (a good review of contemporary methods for studying CVK's is given in [1]).

In this paper we examine a method of analytically modeling CVK's with closed demonstration nets of queuing systems (SMO) used in the study of different organizational variants which was developed in the Novosibirsk Scientific Center of the Siberian Division of the USSR Academy of Science Collective-Use Computer Center (VTzKP) [2, 3]. In spite of the fact that this method naturally reflects certain features specific to the VTzKP, it may be used in the study of a rather broad class of nets of computer complexes and data transmission nets.

Conclusion

This paper presented in detail a method of modeling a SVK with closed demonstration nets of queuing systems. This method used the VTzKP of the Siberian Division of the USSR Academy of Science for the construction of its models. [9-11] The SMO net in the models of the VTzKP included up to 75 systems. Machine time to perform one experiment with the model on the BESM-6 computer was on the average 25 seconds. This shows that the efficiency of the modeling method used and its implementation in a program were adequate.

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[223-9285]

9285
CSO: 1863

APPLICATIONS

UDC 681.324

PROBLEMS IN THE DEVELOPMENT OF COMPUTER NETS

Riga AVTOMATIKA I VYCHISLITEL'NAYA TEKHNIKA in Russian No 1, 1980 pp 3-11
manuscript received 3 Sep 79

[Article by E. A. Yakubaytis]

[Text] Computer nets are the basis for realizing highly effective methods for distributed processing of large information streams. The development of these nets makes it possible to bring together into one system the dynamic processes for management of the national economy, to provide for solution to complex problems by groups of scientists and to offer broad access to specialized data banks.

There are a number of major problems related to the development of computer nets. The principle one of these arises from the fact that industry does not and in the near future will not produce computers or data transmission apparatus designed for distributed network teleprocessing of information.

The "classical" procedure consisting of the development of special machines and apparatus, followed by the construction of computer nets, is not followed for a number of reasons. The most important of these are the possibility for the development of relatively effective nets based on existing computers and apparatus; the inefficiency of developing network computers and apparatus without first acquiring sufficient experiences with the operation of existing computer nets; the inadmissability of giving up for an extended period of time the great economic and social benefits which current computer nets afford.

Thus, today there is only one way to proceed, consisting of the construction of experimental computer nets based on computers, data transmission apparatus and communication links not designed for network teleprocessing. After this, experience with the operation of the constructed experimental nets can be analyzed, followed by the development of special data-computer equipment, effectively solving all the problems of a high speed distributed network for the processing of large streams of information.

In this regard it is important to select a multimachine architecture which will provide the maximum continuity of equipment and software in the transition from the use of separate machines to the development of a complex computer net. The present article is devoted to these problems.

In our times there is an absence of generally accepted terminology in the area of computer nets. Thus, we will introduce the following basic definitions:

Program--a full and precise description in a given algorithmic language of a procedure for processing data, leading to the solution of a problem which has been posed.

Computer--a set of processors, operating with a common working memory and set of peripheral units; where a processor is a piece of hardware, consisting of an arithmetic-logical block and a control device and designed for the execution of commands and a number of other auxiliary functions.

A system is a local interconnected hierarchical group of programs for the acceptance, storage, processing and output of information.

The System. The principle logical concept in the multimachine association is the system, consisting of a number of layers of interrelated programs. The number of these layers, depending on the system structure being used, usually varies from three to seven. In the last years greater and greater acceptance has been accorded the seven layer model of the System, proposed [4] by the International Organization of Standards (MOS). This model is depicted in Fig. 1. The three top layers of this hierarchy make up the Processes--a set of programs, determining the computational resources of the System. The four lower levels make up the Transport Station, providing transmission of information produced or received by the Processes. The principle functions, performed by these seven levels are described in Table 1. The elements of each of these levels are called units. The systems interact with each other across connectives called physical channels.

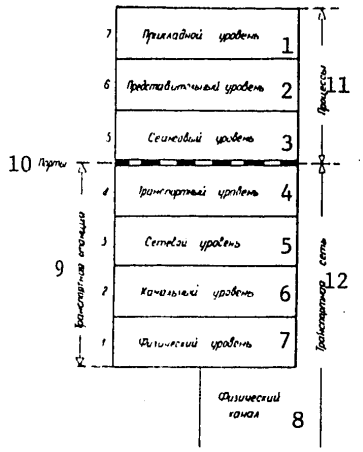

Fig. 1. A Seven-Layer Structure of a System.

Key:
1. Applied level
2. Representative level
3. Session level
4. Transport level
5. Network level
6. Channel level
7. Physical level
8. Physical channel
9. Transport Station
10. Ports
11. Processes
12. Transport Net

Each System is implemented on one or more interrelated computers. The latter is preferred since it makes it possible to specialize each machine, and increase the efficacy and reliability of the System's functioning.

In recent years the International Organization of Standards has been studying [4] the Architecture of open systems, which determines the basis of coordination of various developers and makes it possible to introduce essential international standards. The system which satisfies the requirements of this architecture, is conventionally called open.

Table 1

The Principle Functions Fulfilled by Levels of the System

No levels	Name of the level	Principle Functions
7	Applied	Applied processes: processes for users, administrative control and network service.
6	Representative	Processes for explaining the meaning of information transmitted to the applied processes.
5	Session	Processes organizing the sessions of interaction between the applied processes.
4	Transport	Transmission of information arrays between the ports of the processes.
3	Network	Routing of information streams to the transport net.
2	Channel	Transmission of information along physical channels.
1	Physical	Physical, mechanical, functional and procedural characteristics of interaction with the physical channels.

The Node. We will call a node a set of systems, interacting with each other by means of one of these systems. We call the latter a Communication System. The remaining systems we will call Users' Systems. An example of a node is shown in Figure 2. Here four Users' Systems interact with each other through the Communication System. Each of the five Systems, in the Node must contain a seven-level hierarchy of programs (Cf. Fig. 1) and, in communication terminal (ST) points of interaction with the physical channels, must have identical standards and procedures for exchange of information. Thus, the levels of the programs of the System form the distributed software of the Node.

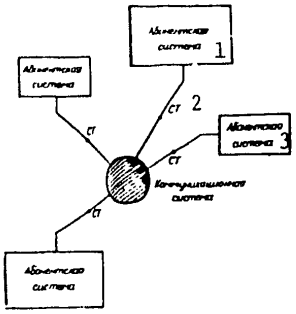

Fig. 2. The Structure of the Node

Key:
1. Users' System
2. ST (communication terminal)
3. Communication system

The processes included in the Systems under consideration determine the computer resources of the Node. In turn, the Transport stations of these Systems and the physical channels which unite them form a Transport Net, providing transmission of information between the ports of these processes.

The Nodes, often also called One Node Computer nets, developed in various management links of the national economy, industrial associations, large enterprises, scientific centers and other organizations, the processing of information in which requires the use of significant computer resources.

The systems, making up the Net, are specialized in different ways, depending on the tasks they are assigned. The most widespread examples of such specialization are shown in Table 2. The number of Systems, making up the Net may vary from four to many dozen. This determines the productivity of the Communication System.

Small organizations may also be interested in the Degenerate Node consisting (Cf. Fig. 3) of several Users' Systems, but not having a Communication System. One of the Users' Systems must be a Working one, and the rest--Working or Terminal. This permits broadening of the possibilities for information processing, increases the efficiency of computer resource use and opens up possibilities for including existing equipment in more powerful multimachine associations. Thus, frequently a Degenerate Node may be the first stage in the development of a computer Net.

Table 2

Examples of Specialization of Systems

No	Name of the System	Tasks Executed by the System
1	Working (Host)	Basic data processing (calculations, program and data banks, information search and directory service).
2	Terminal	Users' Interface: input/output, preliminary data processing and terminal management.
3	Communication	Routing of information streams.
4	Dispatcher	Administrative management of the Node, offering general service to users.
5	Measurement	Measurement of information (technological processes, scientific studies), its filtration (selection) and preliminary processing.
6	Terminal-interface	Provision of interaction of non-standard (for the Node) synchronic and asynchronic terminals with a communication system.
7	Host-interface	Provision of interaction of non-standard (for the Node) working systems with a communication system.

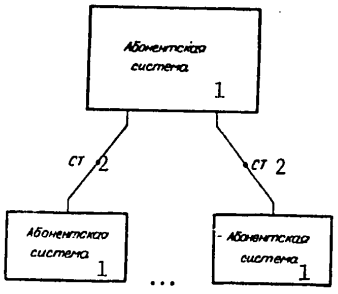

Fig. 3. Degenerate Node

Key: 1. Users' System
2. ST (communication terminal)

Figure 4 depicts the types of System which can go to make up a Node and gives several of their features. For Working Systems it is most effective to use the YeS (Unified System) and "El'brus" large computers. As for the remaining types of Systems, cited in Fig. 1, experience shows that it is

helpful to develop them on the basis of mini and micro computers, primarily the machines of the SMEVM (International System of Small Computers). The reliability of the Communication System must be significantly higher than that of the other Systems. Thus it should be realized by means of two computers which can replace each other.

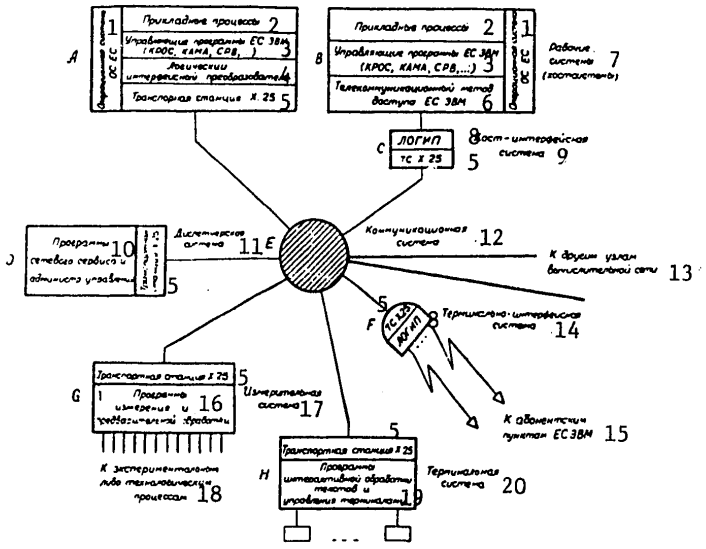

Fig. 4. Types of Systems Used in a Node.

Key:
1. OS (Operating System) of the YeS (Unified System)
2. Applied processes
3. Control Programs of the YeS Computer (KROS, KAMA, SRV...)
4. Logical interface translator
5. Kh. 25 transport station
6. Telecommunication method of access to the YeS Computer
7. Working Systems (Host Systems)
8. LOGIP
9. Host-interface System
10. Programs for network service and administrative control
11. Dispatcher System
12. Communication System
13. To other Nodes of the Computer Net
14. Terminal-interface system
15. To Users' terminals of the YeS Computer
16. Programs for measurement and preliminary processing
17. Measurement system
18. To experimental or technological processes
19. Programs for interactive text processing and control of terminals
20. Terminal system

Each of the Systems making up a Node must satisfy the requirements of the Architecture of open systems. In conjunction with this there exists a large set of computers and user's terminals of the YeS computer which either cannot be or can only inefficiently be adapted to meet these demands. Moreover, it is desirable or even essential to use the powerful operating systems of the YeS computer, a large set of teleprocessing control programs (KROS, ROS, KAMA, OKA, SVR...) and the innumerable list of standard and applied programs written by users. Thus the usual YeS computer software must be supplemented by a complex of programs describing the essential interface translations. They are executed in the computers (stations) of the YeS computer themselves or external to them--in the supplementary interface systems.

Thus figure 4 gives diagrams of Nodes made up of two YeS computers and a group of computer user terminals. In System A based on a YeS computer, essential translations are executed by the Logical interface translator (LOGIP), a complex of programs, implemented on the same machine. System B is made up of a YeS computer with its full complement of standard software. The necessary translations are executed by a Host-interface system which is based on either an SM EVM computer or a group of micromachines. The Terminal-interface system is used to link up the user terminal of the YeS computer (AP-4, AP-61, AP-64 etc.). It is constructed along the same technical principles as the Host-interface system.

The operating systems and control programs for the microcomputers are relatively simple. Thus, adapting them to the standards of the open system Architecture is usually not complex and the Systems realized on the basis of minicomputers are always open. This applies to an even greater extent to Systems developed on microcomputers.

In this regard all Systems presented in Fig. 4, with the exception of System B, are open and have (logically) identical Transport Stations. In regard to the lower three levels of the Transport Station (Cf. Fig. 1), recommendation Kh.25 of the International Advisory Committee on Telegraphs, and Telephones (MKKTT) introduces standards [3] for the exchange of information in communication terminal points, connecting (Cf. Fig. 2) Users' Systems with Communications Systems. In this connection all the open Systems shown on Fig. 4, have Transport Stations satisfying the requirements of Recommendation Kh.25. For brevity they are called Kh.25 Transport Stations (TSKh.25). System B and User terminals of the YeS computer do not have Kh.25 Transport Stations since in the Node, they are represented by Systems C and F respectively.

The applied processes of the Systems, located (Cf. Fig. 1) on the applied level, are divided into three groups. The first contains users' processes, determined by users' programs or the actions of the terminal operators. The second group contains the service routines, offered to users. For example:

directory service on the resources of the Node;
instruction in methods of interaction with the applied processes;
storage of Users' files and correspondence by means of electronic mail service;
the distribution of information streams among identical (in programming sense) Working Systems.

The third group is made up of processes of administrative control providing the execution of the following functions.

control of the status of the system and physical channels;
collection of information about the operation of the Systems and scheduling among them;
interactive diagnosis of the Node;
check on newly connected equipment;
compilation of hard copy documentation;
control of loading of new System software;
giving of information about emergencies and errors;
restoration of a normal state;
compilation of error statistics;
control of the nature of routing;
control of reconfiguration of the Node.

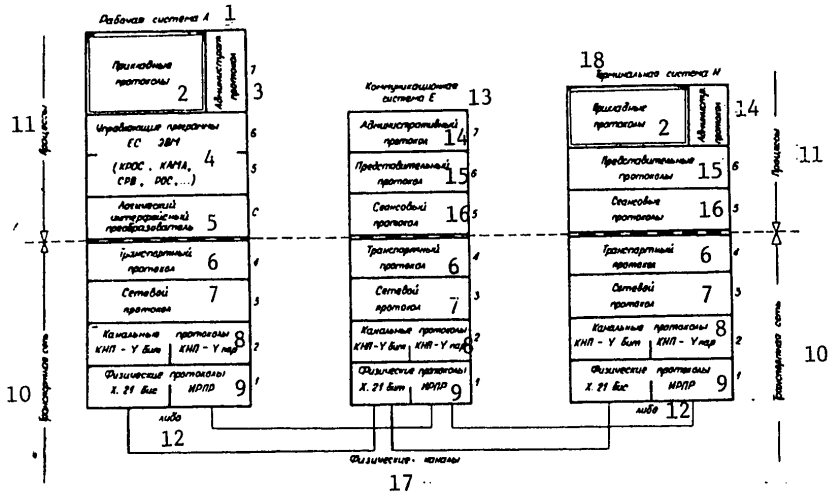

Fig. 5. Protocols

(Note: Key on following page)

Key:
1. Working System A
2. Applied protocols
3. Administrative protocols
4. Control programs YeS (Unified System) computer (KROS, KAMA, SRV, ROS)
5. Logical interface translator
6. Transport protocol
7. Network protocol
8. Channel protocols
   KNP-Y bit KNP-Y pair
9. Physical protocol
   Kh.21 bis IRPR
10. Transport network
11. Processes
12. Or
13. Communication system E
14. Administrative protocol
15. Representative protocol
16. Session protocol
17. Physical channels
18. Terminal system H

Information streams in the Node are divided into two classes: basic and administrative. The first class of streams determines the information involved in the execution of users' jobs and inquiries. The second class contains information, determining the administrative aspects of the functioning of the Node (Cf. above).

Each of these classes, in its turn, is divided into two groups: data and signals.

Data streams determine the information passed among the levels of the Systems. The signal streams are related to the control of transmission of data streams (inquiries about connection, messages about acceptance, error messages, confirmation of connection,...).

Corresponding to the structure of the Systems (Cf. Fig. 1) is a seven level hierarchy of protocols, named for the levels whose operation they determine. The interaction of protocols of neighboring levels is described by interfaces. The hierarchy of protocols of the seven level model is shown in Fig. 5 for the case of the interaction of Terminal System H (Cf. Fig. 4) and Working System A.

It should be noted that, in contrast to Recommendation Kh.25, the Architecture of open systems postulates the presence of several types of interaction with physical channels on the two lower levels of the systems. Such channels can include: sequential bit-oriented, sequential byte-oriented and parallel. Two of them are shown in Fig. 5. A bit-oriented channel can be defined by Recommendation Kh.25 in accordance with which the Kh.21 bit

physical protocol and (KNP) channel protocol of Y bits where Y is the number of versions that are introduced. The physical protocol for the parallel channel is described by the standard, introduced by the SM EVM under the name Radial Parallel Interface (IRPR). Over it is the KNP-Y pair channel protocol. It must have the same interface with the network protocol as the KNP-Y bit. Because of this the network levels of the System can operate with channels of several (here-two) types.

It is natural that User systems, making up a Node, can execute various Physical and Channel protocols, but only those which are used by the Communication system. However, the Network and Transport protocols of all the Systems (User and Communication) for providing transmission of information streams must be completely identical. As for the Processes, they, in various groups of Systems, can have identical as well as different sets of Session, Representative and Applied Protocols. These sets determine the specialization of the Systems as well as the software used in the Node for the computers implementing these Systems. In the Node three types of interaction are distinguished:

1) terminal-computer,
2) terminal-terminal,
3) computer-computer.

The first and second types are analogous, corresponding to the interaction in contemporary tree-form teleprocessing with a central computer. However, with distributed teleprocessing the terminal may interact not with one, but with all the machines making up the Node. Interaction of the third type is new and is introduced later, for preparation of complex problems which are solved by various interacting systems without user participation.

The Net. The Computer Net (Net) is a set of Nodes constructed according to identical standards, which interact through physical trunk channels. An example of a Net, consisting of seven Nodes and nine trunk channels is given in Fig. 6.

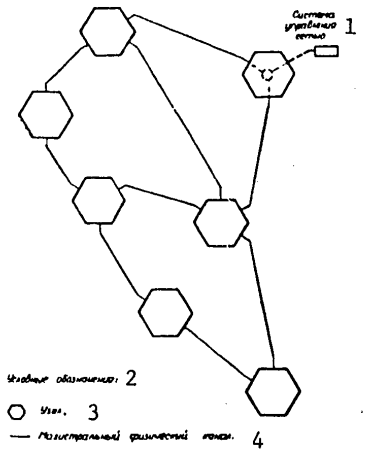

Fig. 6. The Structure of the Net

Key: 1. System of Net Control
2. Designation
3. Node
4. Physical trunk channel

What was said in previous sections about the System and Node fully applies to the Net as well. All the protocols, software and equipment of the Nodes, with two exceptions, remain unchanged. Thus in the development of the Node, it is essential to give special attention to two problems: administrative control of the Net and the interaction of Communication Systems.

Administrative control of the Node is performed by the Dispatcher system. Analogous to this, the Net must have a System for its control, directing the operation of the Dispatcher systems of all the Nodes and, with their help, performing the general administrative control of the net. This System may be constructed in two ways. In the first case, shown in Fig. 6, when the Net is developed, a System for its control of A based on a minicomputer is added to one of the Nodes. In the second case, a program executing control of the Net is added to the seventh level of the Dispatcher system of one of the Nodes.

Technically the second method is simpler. However, from the point of view of policy in the control of the Net the first is preferable. Indeed, when the second method is used, it gives the impression that one of the Nodes is the main one and that the administrative control of the whole Net is arranged to favor the interests of this Node and its associated industrial association, scientific center etc. In the construction of the separate system, Net control can be located in any necessary place, independently of the Dispatcher system. Moreover, in this case it has a separate staff of operators, subordinate to "head" of the Net.

The System of Net control has approximately the same tasks to perform as in the administrative control of a Node. However, the former relates not just to the resources of the Node, but to the whole Net. And because of the presence in each Node of its own Dispatcher system, the tasks are performed differently. For example, the Dispatcher system gathers information about the operation of all the Systems in a Node. Thus, the System of Net control obtains the information necessary to it, not from all the Systems of the Net but only from the Dispatcher systems.

The second addition which must be accomplished in the uniting of Nodes into a Net, is related to the necessary interaction of (a frequently significant number of) Communication systems. Thus, the list of functions performed by these Systems must be expanded to include functions providing a complex routing of information by a significant number of Communication systems.

Conclusion

At present in various links of management, industrial associations and scientific centers of the nation there is a signigifant stock of YeS computers and minicomputers of various types. The information processing and computational processes performed here urgently pose the question of the necessity of connecting these computers in multimachine associations,

providing for complex processing of information for these organizations. The analysis performed above and experience with the operation of a One Node Experimental Computer Net of the Academy of Science of the Latvian SSR [1, 2] indicates that the most effective form for these associations is Nodes, satisfying the international standards of the MOS (International Organization of Standards) and MKKTT (International Advisory Committee on Telegraphs and Telephones). The subsequent uniting of these Nodes into a Net permits the solution of complex problems in the management and processing of information.

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QUESTIONNAIRE COMPUTER PROCESSING PROGRAMS

Tallin SISTEMA PROGRAMM DLYA OBRABOTKI ANKET NA YES EVM in Russian 1979 pp 6-7, 158

[Table of Contents and Excerpt from the Introduction of the book "A System of Questionnaire Processing Programs for Unified-System Computers" by M. Khoolma and I. Petersen, Estonian SSR Academy of Sciences Institute of Cybernetics, 500 copies, 159 pp]

[Excerpt] ...this description of the program system begins with a presentation of the fundamental concepts of the questionnaire survey (§ 1) and some instructions on planning the questionnaire (§ 2). If the reader is interested not in questionnaire processing but in processing qualitative information of other content, it would not be difficult for him to tailor the content of these sections (and those following) to his own needs.

Next follows a description of the general pattern of questionnaire processing by the system (§ 3). Punched questionnaires, information on questionnaire structure and on the question-and-answer codes and descriptions of the response tables printed out by the computer and different program parameters make up the punch card banks. A description and the rules of punching out these data banks are presented in § 4. § 5 and § 6 give the necessary information on using the programs in the (DOS YeS) operational system. The system's individual programs are described in §§ 7-16. § 17 presents a description of response distribution tables and the formulas used to compute the conjugation coefficients. The meaning of the latter is explained in § 18. § 19 presents the results and all of the control information for one control problem. This example should be referred to whenever questions arise concerning the coding or punching of the punch card banks. All forms of response tables may also be examined in their natural appearance in the same section. Finally, § 20 provides brief instructions on how to use this system with unified system-computers.

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[314-11004]

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PROBLEMS OF DESIGNING AUTOMATED CONTROL SYSTEMS FOR LOCAL INDUSTRY IN A REGION

Moscow PROBLEMY SOZDANIYA ASU MESTNOY PROMYSHLENNOST'YU V REGIONE in Russian signed to press 19 Mar 79 pp 3-4, 5, 147, 148, 159

[Excerpts from the book by L.Sh. Gaft, V.A. Nesterov and V.A. Sinitsin, Statistika Publishers, Moscow, 4,800 copies, 159 pages]

[Excerpt] Introduction

A characteristic feature of local industry is the predominance of medium and small enterprises, as well as the fact that it is diversified over individual regions. A consequence of this particular feature is that the coordination of the operation of the subdivisions of local industry is made difficult, and for this reason, the significance of control is extremely great here. However, if we turn to practical developments in the design of ASU [automated control systems] in local industry, then a considerable lag behind other sectors is observed here. Work on the planning of ASU's is going forward only in a few regions, in which case, only one of them - the creation of the ASU of the Rostov oblast local industry administration - has been brought to the point of introduction and placed in service.

There is also approximately the same lag in the field of theoretical developments in ASU design for local industry. Literature devoted to the use of computers in managing local industry is figured in units [2, 7, 8, 10, 13, 16].

The difficulty in resolving the problem of automating control of local industry consists not only in that as yet insignificant practical experience has been acquired in this area and there are almost no theoretical developments. Something else is also involved.

The creation of an ASU not only brings about an improvement in management and an increase it i*s efficiency. It is generally recognized that the creation of an ASU itself requires getting things in order beforehand, and improving control efficiency. Moreover, the general questions of the theory of the control of local industry have as yet been given little coverage in the literature [9, 11, 21].

Until now, a definition of local industry as a part of the socialist state industry has not been worked out, and the differences between local industry and other sectors, and because of this also the specific features of the control of local industry have not been ascertained. Because of this, the general procedural fundamentals for the desig of ASU's for local industry have not been worked out.

The results of research performed by the Institute of Industrial Economics of the Ukrainian SSR Academy of Sciences served as the theoretical and procedural basis for the developmental work. The cooperation of scientists, designers and production engineers has made it possible to consider both the general theoretical principles for the design of automated control systems as well as the actual requirements of practice in the creation of the system, something which assured the introduction and was responsible for the high efficiency of the "ASU - Rostoblmestprom" ["The Automated Control System for Rostov Oblast Local Industry Management"].

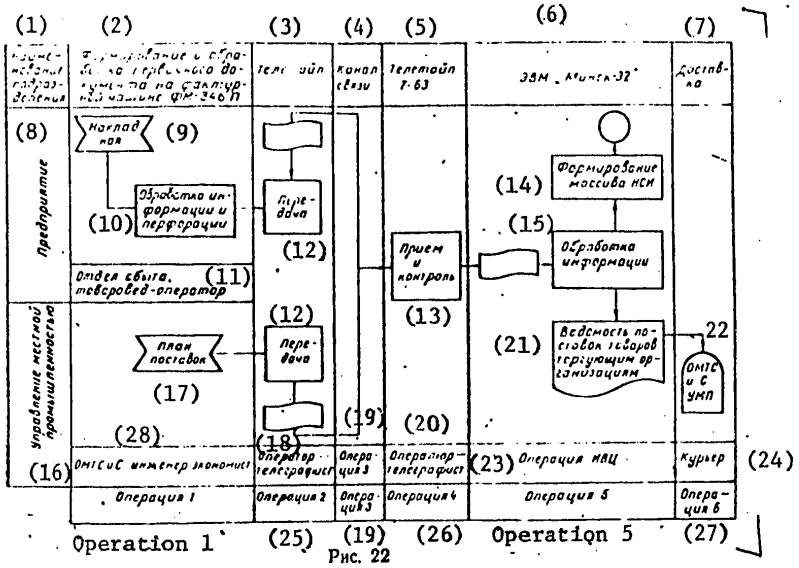

Рис. 22

Figure 22.

Key: 1. Designation of the subdivision;
2. Generation and processing of the primary document on the FM-346P invoicing machine;
3. Teletype;
4. Communications channel;
5. T-63 teletype;
6. Minsk-32 computers;
7. Delivery;

[Key to Figure 22, continued]:

8. Enterprise;
9. Consignment note;
10. Data processing and keypunching;
11. Marketing department, merchandising specialist operator;
12. Transmission;
13. Receiving and testing;
14. Generation of the NSI [not further defined] data file;
15. Data processing;
16. Local industry management;
17. Deliveries plan;
18. Teletype operator;
19. Operation 3;
20. Teletype operator;
21. Report of goods deliveries to trading organizations;
22. Materials and equipment supply department and S [not further defined] of the UMP [local industry administration];
23. Operation of the information computer computer center;
24. Messenger;
25. Operation 2;
26. Operation 4;
27. Operation 6;
28. Engineer economist of the materials and equipment supply department and S.

The economic efficiency of an ASU is defined by the annual increase in the income of the local industry of a region which is related to the functioning of the control system, the annual economic impact and the efficiency of the expenditures for its creation. They are computed on the basis of the "Procedures for the Determination of the Economic Impact of Automated Control Systems of Enterprises and Production Associations", authorized by the decree of the State Committee of the USSR Council of Ministers for Science and Technology, USSR Gosplan and the USSR Academy of Sciences of 17 July, 1976, No. 379/86/34 [15].

The annual growth in income (E_{year}) is computed by the formula:

$$E_{year} = \frac{(A_2 - A_1)}{A_1} \cdot P_1 + \frac{(C_1 - C_2)}{100} \cdot A_2$$

where A_1 and A_2 are the annual volume of product output before and after the introduction of the ASU (thousands of rubles); P_1 is the income from the product output prior to the introduction of the ASU (thousands of rubles); C_1 and C_2 are the expenditures in kopecks per ruble of product output before and after the introduction of the ASU.

The annual economic impact (E) is determined from the formula:

$$E = E_{year} - Y_n \cdot K_d^a$$

where Y_n is the normative coefficient for the economic efficiency of the capital investments in the local industry; K_d^a are the expenditures related to the design and introduction of the ASU (thousands of rubles). The efficiency of the expenditures (T) is determined from the formula:

$$T = \frac{K_d^a}{E_{year}}$$

The raw data for the design calculation and the design indicators are given in Table 21.

The calculation of the annual expenditures for the operation of the information computer center is given in Table 22.

[Annotation]

The practical experience with the automation of the control of a local industry in a region is generalized in this book. The procedural fundamentals for the design of an ASU for a local industry in a region and the refinements of the organizational control structure under conditions of its automation are treated. The methodology which is worked out was realized as applied to the ASU-Rostoblmestprom, but the basic design solutions can be utilized in other regions.

The book is intended for the workers of scientific research and project planning institutes, computer centers and the regional administrations of local industry, as well as students and graduate degree candidates of the higher educational institutes.

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UDC 658.011.56 (474.5)

IMPROVEMENT OF CONTROL OF PRODUCTION UNDER ASU CONDITIONS

Vilnius SOVERSHENSTVOVANIYE UPRAVLENIYA PROIZVODSTVOM V USLOVIYAKH ASU in Russian 1979 signed to press 23 Feb 79 pp 2, 12, 13, 14, 19, 20, 21, 22, 25, 26, 27, 28, 29 40, 41, 83, 140, 141, 143, 214

[Annotation, table of contents and excerpts from the collection of articles "Sovershenstvovaniye upravleniya proizvodstvom v usloviyakh ASU" edited ty P. Stanikas, Institute of Economics, Lithuanian SSR Academy of Sciences, 400 copies, 214 pages]

[Excerpts] Annotation

The main directions in the improvement of the control of production under the conditions of the functioning of ASU in industry of the Lithuanian SSR are analyzed in the collection. Experience is generalized and some ways to elevate the scientific and technical level of the ASU at enterprises and associations of the machine-tool, instrument, electrical equipment, light and furniture industries of the republic. Questions of the improvement of the management of scientific developments and of the quality of production under ASU conditions also are studied. The collection is intended for specialists working in the area of improvement of the control of production under ASU conditions.

CONTENTS

In 1979 the first lines of 16 ASU of ministries, departments and state committees and over 60 ASU of enterprises, associations and organizations were already in operation in the republic. Work is being done on the further development as such intesectoral ASU as an automated system for state statistics and an automated system for control of material-technical supply.

In the republic much importance is attributed to the creation and introduction of automated control systems for planning calculations (ASPR) for the Gosplan of the republic. The first line of the ASPR was put in operation in 1976 and the further development and improvement of that system continues. At the present time in the ASPR about 270 economic-planning tasks have been prepared, and calculations for 7 summary and 14 sector functional subsystems, almost 25 percent of them with the use of complex economic-mathematical methods of planning and forecasting.

The problem of the interaction of the ASPR with other ASU of the republic is only starting to be solved now, because of a definite lag in the creation of planning and forecasting subsystems within the sector ASU of the republic, the complexity in the development and introduction of effective economic mathematical methods and models of sector planning and forecasting, imperfection of the methodology for determination of the forecasting and planning indicators on the level of the sector, association and enterprise, and other factors.

Taking into consideration the complexity and labor-intensiveness of work being done in the republic on improvement of control on the basis of the wide use of electronic computers, the Gosplan of the republic jointly with the Academy of Sciences, the Central Statistical Administration, the Ministry of Higher and Secondary Specialized Education, the Ministry of Communications and other ministries and organizations has developed a purposive complex program of work on the development of the republic ASU of Lithuania for 1981-1990, which was approved in 1978 by the Interdepartmental Council for Questions in Improvement of Control of the National Economy.

On 1 July 1978 there were 227 electronic computers with a total capacity of 7.5 million operations per second in the Lithuanian SSR, 77 of which were concentrated in industry. About 12,000 persons are working in various subdivisions engaged in the development, introduction and operation of ASU and computer technology.

Analysis of the economic effectiveness of ASU functioning, made at machine-building enterprises of the republic, showed that expenditures on the introduction of ASU and computer technology amount to 5.0-6.5 percent of all expenditures on new technology, but the percentage of the annual saving from those measures is only 4.1-4.2 percent of the total annual saving from the introduction of all new technology. The repayment period for measures on ASU and computer technology also is greater than for such measures as the introduction of progressive technology, automation and mechanization of productive processes. In isolated cases it even exceeds the standard period for repayment of expenses.

The directions of the problems solved can be judged by data on the distribution of the volumes of work done by computer subdivisions of machine-building enterprises and associations of the republic. Thus, in the total volume of work done, 56.8% of the hours are expended on processing economic data, including 26.1 percent on accounting-statistical, 22.8 percent on planning-standard and 8 percent on data on material-technical supply. About 20 percent of the entire volume of computer work is done on the preparation of production, and about 23.0 percent on scientific-technical and planning-design calculations.

Analysis of the state of use of computer technology at machine-building enterprises and associations of the republic in 1977 revealed important shortcomings in both the plan and in the activity of the computer centers them selves. Thus, the average daily load of the electronic computers amounts to about 75 percent of the established standards, losses of working time about 8 percent, and the solution of optimization tasks, a total of about 4 percent. Such a situation results from the scattering of computer technology resources over enterprises and associations and the absence of a unified system of planning the use of computer technology and the activity of computer centers.

Starting from the requirements for increase of the effectiveness of use of computer technology resources, it is necessary to intensify the centralization of available computing capacities and create large multiple-user computer centers through the organization of user stations equipped with terminals.

Analysis of the state of the provision of ASU and computer centers of the republic with personnel has shown that only 23 percent of the specialists of the total number employed in that area have a basic education in the designing and introudction of ASU and the use of computer technology,

Table 1. ASU indicators at enterprises and associations of industry of the Lithuanian SSR on 1 January 1978

Indicators	Total	Including: production associations	Including: enterprises
Presence of ASU on 1 Jan 78, including:	37	14	23
functioning on their own technical base	18	7	11
put in operation in the planned volume	14	6	8
Number of subsystems			
according to plan	220	87	133
actual	187	71	116
Number of tasks solved			
according to plan	1406	634	772
actual	1086	343	743
Optimizational in the total number of solved tasks, %			
according to plan	8.6	2.2	9.8
actual	10.0	2.3	13.5
Expenditures on creation of introduced ASU, 1000 rubles			
according to plan	22,522.2	8,992.8	13,529.4
actual	23,078.0	8,309.4	14,764.6
Annual saving, 1000 rubles			
according to plan	8,614.0	3,985.8	4,628.2
actual	4,342.7	1,307.7	3,035.0

which is clearly insufficient both to provide for the development of qualitative ASU plans and their efficient functioning but also the timely organization of new computer technology and its best use.

At the present time specialists are distributed by sectors of the national economy in the following manner (in 1977): 37.8 percent in industry, 12.3 percent in agriculture, 5 percent in transport and communications, 2.9 percent, 4.2 percent in trade and catering, 2.8 percent in material-technical supply and 35 percent in other sectors. The structure of the distribution of specialists by specific specialties requires improvement. In some sectors the number of specialists with a technical inclination (engineers to service electronic computers), and in others the developers of ASU predominate (mathematicians, economist-mathematicians, etc). Because of this it is necessary to work up standards by separate groups of specialists as a function of the volume of the planning work done, the available computer capacities and the number of computer centers (with the prospects of development taken into consideration).

Until recently questions of the organization of document exchange between a plant administration and shops solely through electronic computers were solved with difficulty. Work requiring standardization of the primary documentation is unquestionably labor-consuming, but that cannot justify the slow rates of introduction of ASU into all forms of the control of production.

Of no less importance is the capable use of economic-mathematical models in the automation of economic planning work. Unfortunately, such economic-mathematical models, which would very adequately reflect real production processes, are not always used at the enterprises.

It should be noted that an ASU will not be effective when old forms and structures of control are preserved. An ASU requires an organic combination of the electronic computer and new approaches and methods of control which are effective under the conditions of new organizational structures of control.

All the enumerated factors that prevent rapid increase of the effectiveness of operating ASU can be regarded as components of an incorrect general approach to the introduction and operation of ASU. Analysis of ASU functioning at enterprises and associations gives a basis for concluding that the general approach or methodological basis which are laid down during the designing, and to a still greater degree during the introduction, suffer from an important shortcoming: it is not followed by a purposeful development of an economic-organizational model of the ASU. And that is the main prerequisite for effective ASU functioning and by the same token improvement of the general system of control of production. The economic-organizational models ought to be formed by the ASU developers in close contact with superior administrative personnel. In practice, however, this often occurs formally, and the ASU is introduced and developed without a clear directivity.

The ASU system must be distinctly formed and provided for. Thus, in the information-computer center of the "El'fa" association three computers, a Minsk-32, a YeS-1022 and an M-5000, are working which do not have a common data input and output system or the possibility of using the same data files. Such mismatching hinders the effective functioning of the ASU, as additional labor expenditures are required for the introduction of data files from one computer into another.

Improvement of control of production at the enterprise depends to a great extent on the scientific and technical level of the ASU.

The ASU is evaluated by the Temporary Method*, approved by resolution of the State Committee for Science and Technology under the USSR Council of Ministers No 459 dated 12 July 1974.

According to that procedure the scientific and technical level of an ASU is determined in points on the basis of four specific indicators of the ASU level: the economic indicator of the ASU level (y_e), the systems-technical indicator of the ASU level (y_s), the indicator of the level of embracing by automation of tasks of control (y_t) and the indicator of the level of organization of production and labor (y_o). The summary (integral) indicator of the ASU scientific and technical level is calculated with the formula:

$$y_{ASU} = K_{ts} \cdot y_e + K_t \cdot y_t + K_o \cdot y_o.$$

The hardware concentrated in a territorial computer center includes two "Minsk-32" computers and the necessary auxiliary equipment used for data input, processing and output. At the present time a YeS-1033 computer has also been put in operation in the Vilnius territorial computer center.

In the Ministry of Light Industry of the Lithuanian SSR the first line of an automated control system for a sector of industry, based on a "Minsk-32" computer, has been functioning since 1975. A third-generation YeS-1033 computer has now been received for that developed sector ASU of that ministry. The basic data characterizing the sector ASU of the ministry are presented in Table 3.

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*Vremennaya metodika opredeleniya nauchno-tekhnicheskogo urovnya avtomatizirovannykh sistem upravleniya proizvodstvennymi ob"yedineniyami (kombinatami) i predpriyatiyami (Temporary procedure for determining the scientific and technical level of automated management systems of production associations (combines) and enterprises). Moscow, 1977.

Table 3. Characteristics of the ASU of light industry of the Lithuanian SSR

	Line 1	According to plan
Estimated cost, 1000 rubles	1,190	2,090
Capital expenditures, 1000 rubles	410	1,510
Saving, 1000 rubles	900	1,800
Repayment period, years	1.5	1.91

Table 5. Main indicators of the introduction and use of computer technology in the Ministry of Light Industry of the Lithuanian SSR in 1978

Indicators	
Total number of administrative personnel, persons	5,853
including in central administration	141
Total annual administrative expenses, 1000 rubles	10,882
including those of the central administration	330
Volume of capital investments on computer technology, 1000 rubles	160
Annual volume of work on ASU planning, 1000 rubles	470
Annual saving from use of computer technology, 1000 rubles	550
Personnel in ASU subdivisions, persons	229
including those engaged in:	
servicing computer equipment	53
using solved tasks	98
ASU planning	66

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GENERAL INFORMATION

CONFERENCES

BASIC AREAS OF DEVELOPMENT AND INTRODUCTION OF PROGRAMMING TECHNOLOGY TOOLS

USSR CONFERENCE PAPERS in Russian

[Article by V. P. Kupriyanov, Deputy Director General]

[Text] The preceding speaker gave a detailed report on the organization of follow-up in the USSR. In my report I should like to give a few more details on certain aspects of the activites of the follow-up service of the "Tsentrprogrammsistem" [central programming systems] Scientific Production Association. The problems of the tools and the procedural follow-up support of the software will also be investigated.

From the system investigated in the preceding report it is clear that the software support of the users is provided through the "Tsentrprogrammsistem" Scientific Production Association library.

The concentration of the software makes it possible to obtain serious advantages among which I should like to mention the following:

The prerequisites are created for proper determination of the demand and efficient utilization of the program potential;

The concentration of the software makes it possible to investigate the problems of insuring completeness of the software;

It provides for the development of methods of evaluating the software products and the potential of the software developers, respectively;

It makes it possible to introduce industrial methods of maintaining the software.

Let us give more detailed consideration to how the last two of the above-mentioned aspects are realized and with what effect.

The concentration of the follow-up functions in one company is highly advantageous, but it at the same time creates defined difficulties.

The primary difficulty is the organization of the interaction of the program developer and the follow-up service specialist from the point of view of adequate understanding of the functions and elements of the software. The complexity of modern software does not allow for it to be "seen" as a whole. If such an effort is made the follow-up service specialist is forced to know the software on the level of the developer, that is, the company providing the follow-up service must have in practice resources close to the total expenditures of the developer companies.

In this situation it is necessary that the follow-up service be able to analyze only on the level and only the elements which are needed to overcome the difficulties encountered when introducing the software.

Inasmuch as the libraries collect software with sufficiently standard functions, on the average no more than 5% of the elements are subject to modification, which makes it possible for the follow-up service to effect small changes directly. Serious changes are made by the developer. It is only under such conditions that the company providing follow-up can effectively maintain the products of the developer companies, the potential of which significantly exceeds three sources.

However, it is very very difficult to implement this approach with the traditional methods of writing programs. "Well-structured" software can be guaranteed only by the application of special processes based on regulatable principles of decomposition (functional, with respect to data or anything else).

However at the present time it must be stated that the problem of the formalization of the decomposition principles has still been far from solved. Therefore the documents must reflect the composition process with substantiation of the adopted decisions. In this case the follow-up service specialist can isolate the element required by him and establish the required relations.

From what has been stated above it follows that in order to organize effective follow-up by small forces it is necessary to develop, fix (as standards) and introduce a process for creating software. Inasmuch as the technology depends on the properties of the final product it is interesting to consider what requirements the user proposes.

The experience of following up the software in the "Tsentrprogrammsistem" Scientific Production Association has demonstrated that, above all, the following properties are needed at the present time:

Functional completeness;

The presence of effective follow-up;

Reliability;

Good quality of documentation.

It must be noted that the requirements on the efficiency of the programs are more and more being relegated to the second level.

The presence of a separate follow-up service allows for objective evaluation of the quality of the software products. The problems of the methods and criteria for evaluating the quality of software constitute one of the most urgent problems of our time. This was also confirmed by the working conference on software quality held last year under the aegis of the IFIL (sic)[1].

The approaches used today can be characterized as the investigation of a product on the program level, obtaining certain intermediate estimates by which it is possible to judge (frequently on the statistical level) the properties of the final product. The investigation and the development of the tools is proceeding in two directions:

The investigation of the program system on the level of the "black box," basically in the loading test unit mode by statistical methods and the methods of simulation;

The investigation of the program system on the level of the "transparent box" on the level of the program flow charts and on the level of monitoring the regulatable principles.

Both of these areas are being developed and constitute elements of the industrial methods of maintaining software.

The process of creating software not only must guarantee that products will be obtained with individual characteristics, but also it must provide for the interface between the developers of various specialties and the follow-up service specialists. It also must insure the basic principles of industrial production of software (the phase approach, methods and means of monitoring the developments and many other principles discussed at length in preceding reports).

Beginning with the enumerated conditions, it is possible to formula specific requirements on the process:

1) it must encompass the largest possible steps in the life cycle of the program;

2) it must be constructed on the principle of separation of controllable steps;

3) it must insure the consumer characteristics of the final product;

4) it must insure that maintainable products will be obtained (good structuring, description of the decomposition process, the presence of a dictionary within the limits of the design, and so on);

[1][Translators note: This is possibly a printer's error. It may be the IFIP [International Federation of Information Processing]].

5) it must have supporting tools;

6) it must be based on a sufficient set of standards and regulating principles;

7) it must be available for use.

The Ministry of Instrument Making and the Academy of Sciences are working on a process for creating software that can be maintained well and the tools to support it.

At the present time a methodology is being introduced for the creation of generalized purpose software based on the method of step-by-step improvement with the application of the principles of modular and layered programming. The results of the introduction of this methodology indicate the high reliability of the programs (on the average, 3 errors per 1000 lines of code) and a good structural nature of the finished product.

However, it is possible to note some basic difficulties in the introduction of the given methodology, especially the difficulties on a technological and organizational level (for example, it is difficult for the developer to become accustomed to working without seeing the program as a whole). High discipline and conscientiousness are required when performing the most elementary operations.

The presence of tools is at the present time a necessary condition of introducing any process. The experience in the development and introduction of tools at the "Tsentrprogrammsistem" Scientific Production Association permits the basic requirements on them to be formulated:

1) all aspects of the methodology must be maintained;

2) they must be functionally open;

3) they must have a unified information base for the designs and the general dictionary of accepted terms and concepts within the limits of the design;

4) they must be convenient to use and promote increased productivity of labor of the developers.

At the present time the tools supporting the methodology consist of eight packages operating autonomously. The operations are performed by coordinating them into a unified program complex. Their use has helped to lower the psychological barrier during introduction of modern methodology. The functions of the tools basically support the operations on the level of the system architecture.

The effectiveness of the tools, in our opinion, will be achieved by creating optimal working conditions for the developer when creating the programs and the documentation. This can be achieved by separation of the operations

connected with creating the software product and the operations pertaining only to the use and maintenance of it, that is, separation of the "developer machine." The functions of this machine must be:

Storage of the specifications of various levels of provision of access to them;

Machine control of the specifications (for example, checking for information compatibility);

Provision for parallel development of the design and documentation;

Storage of the program codes and the elements of the documentation and provision for access to them;

Provision for automated preparation of all aspects of the assignment on the "functioning machine."
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2.2 BASIC COMPONENTS OF DESIGN AUTOMATION SYSTEMS

USSR CONFERENCE PAPERS in Russian

N	System	Hardware																			
		Means of gathering, processing and storing process design documents							Terminal equipment										Automated work areas	Minicomputers and microprocessors
		External memories				Processors			Input devices				Output devices								
		Magnetic disc	Magnetic tape	Magnetic drum	Single processor	Multi-processor	Light pencil	Keyboard	Punchcards	Punchtapes	Alphanumeric print-er	Punchcards	Punchtapes	High-speed printer	Alphanume-ric dis-play	Graphical display	Plotter		
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20		
1	ARKUS	+	+		+			+	+	+	+	+	+		+						
2	MARS	+	+		+			+	+	+	+	+	+		+						
3	ISDAS	+	+		+	+		+	+	+	+	+	+	+	+	+	+	+	+		

2.2

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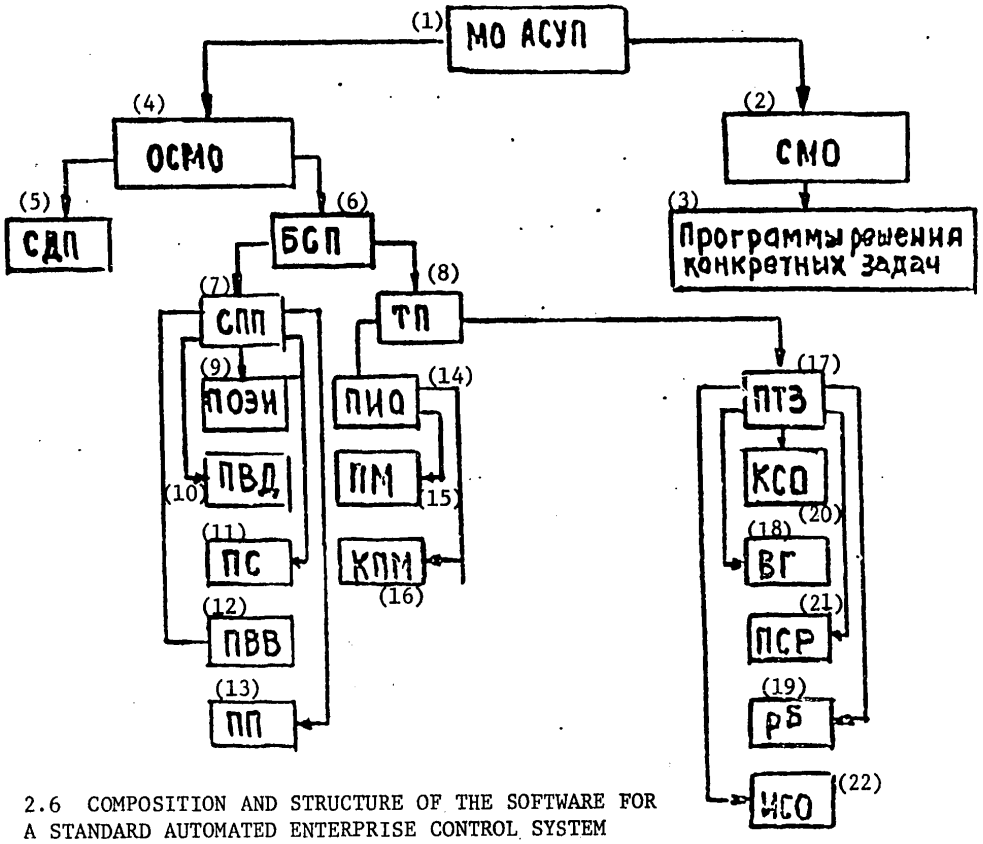
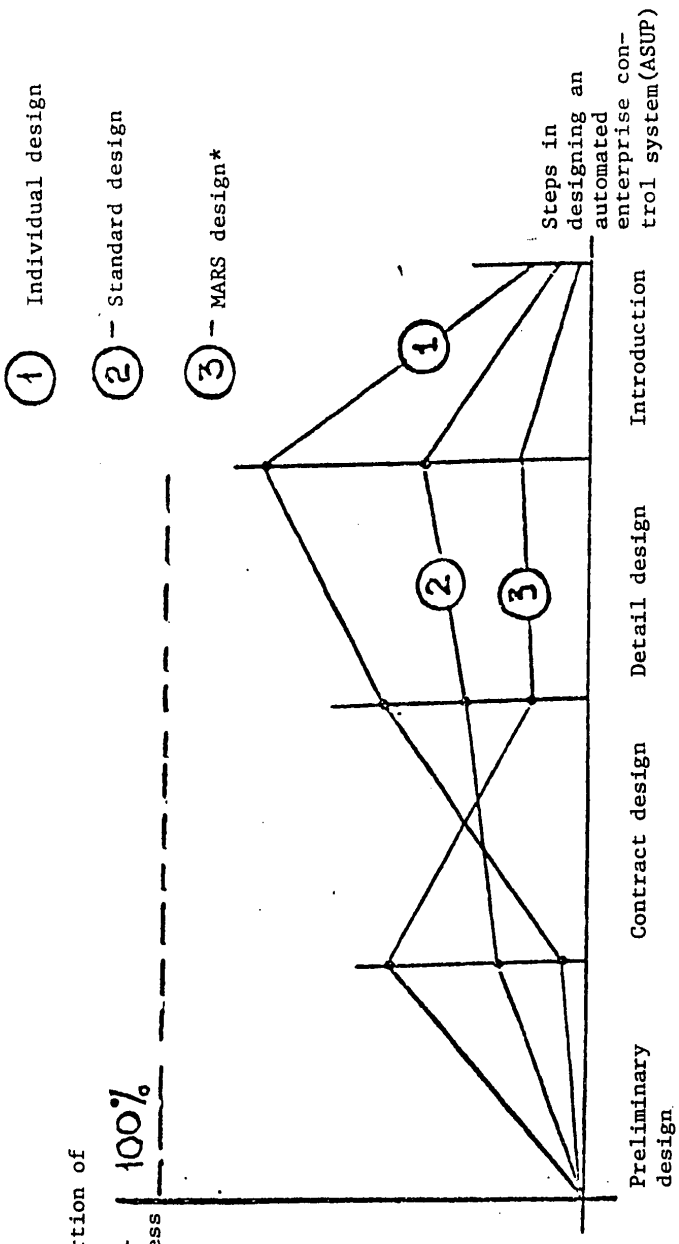


2.6 COMPOSITION AND STRUCTURE OF THE SOFTWARE FOR A STANDARD AUTOMATED ENTERPRISE CONTROL SYSTEM

USSR CONFERENCE PAPERS in Russian

Key:
1. software for automated production control system
2. software systems
3. programs for solving specific problems
4. general systems software
5. SDP [diagnostic program system?]
6. library of subroutines
7. standard subroutines
8. standard programs
9. subroutines for processing information units
10. [data access subroutine?]
11. sorting subroutines
12. input-output subroutines
13. collating subroutines
14. information support programs
15. file preparation and organizing programs
16. file monitoring and printing programs
17. standard problem programs
18. group execution
19. budget problem calculation
20. calculation of quantitative composition of item
21. preparation of summaries with respect to various sections
22. information retrieval programs



2.13 DIAGRAM OF THE RATIO OF THE LABOR INTENSIVENESS OF DESIGNING AN AUTOMATED ENTERPRISE CONTROL SYSTEM (ASUD)

USSR CONFERENCE PAPERS in Russian

* [Intersectorial automated republic system]

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PROBLEMS OF ORGANIZING THE FOLLOW-UP FOR THE SOFTWARE OF THE AUTOMATED CONTROL SYSTEMS IN THE USSR

USSR CONFERENCE PAPERS in Russian

[Article by V. P. Tikomirov, Director General]

[Text] Broad application of computer engineering means in the national economy of the USSR has become one of the most important areas of improving the efficiency of social production, improvement of the production quality. At the same time the USSR is solving the problem of further development and improvement of the efficiency of automated control systems.

The efficiency is being improved by converting to industrial methods of creating the software for the automated control systems. The essence of the industrial methods of creating automated control system software consists in organizing the large-scale development of the computer software, centralized follow-up of this software and the introduction of the software into the automated control systems.

The automated control system software includes the following:

The general systems software: the control systems for the data bases, the information retrieval systems, and so on;

The sets of functional-purpose applied programs which contain programs implementing various methods of controlling the objects of the national economy and having means of automated adaptation (generation) for the parameters of specific objects of control;

The technological means of automating programs and the design of the automated control system programs.

The centralized follow-up of the software has become a necessary element of the software production industry, for it provides for the possibility of delivering automated control system software of guaranteed quality as ordered by the enterprises and organizations of the various branches of the country.

The following operations are performed during the processing of following up the automated control system software:

Centralized control of the software developments which can be used in the automated control systems for various objects of the branches of the national economy of the country.

The production of software and delivery of this software;

The revision and modification of the software.

The centralized control of the software developments includes planning and coordination of the developments of the scientific research work on automated control system software in the following areas:

1. Intersector, defined by the programs of the USSR State Committee on Science and Engineering.

2. Sector, performed in accordance with the thematic plans of the organizations of the Soyuzsistemprom and other associations (TsFAP [Centralized Data Bank of Algorithms and Programs] and OFAP [Sectorial Data Bank of Algorithms and Programs]).

3. Initiative, that is, by the acceptance at the centralized library of the software developed by the organizations and enterprises of various ministries and departments of the country on an initiative level and having intersector application.

The planning of the developments of standard software with respect to the first area is regulated by the State Committee of the USSR for Science and Technology on the basis of the proposals of the main organizations for the development of automated control systems within the branches of the national economy. The primary goal of the scientific research work in the given area is a unified scientific-technical policy for the USSR in the field of creating applied software for automated control systems.

On the sector level the primary documents for the organization of the control of the developments are the five-year and annual plans for scientific research work to create the automated control system software of the organizations of the Ministry of Instrument Making. The five-year plan has a sliding nature and is subject to annual revision. A unified system of planning and organization of the developments of automated control system software has been established within the organizations of the Ministry of Instrument Making and is reflected in the corresponding sector standards. The procedure has been established, according to which the final planned step in the development is the acceptance of the automated control system software at the "Tsentrprogrammsistem" Scientific Production Association.

The coordination work consists in matching of the technical assignments, the contract and detailed designs, the preparation and performance of departmental tests.

The problem of the expediency of centralized library acceptance of the standard software developed by the enterprises and organizations of the country on the initiative level is being solved by the leading specialists of the "Tsentrprogrammsistem" Scientific Production Association specifically with respect to each nomenclature item. Primary attention is being given to the problems of innovation, effectiveness of application, urgency of development, discovery of the number of future users, convenience of application using adaptation means, quality and reliability of the programs, and so on.

During the process of producing automated control system software the following operations are performed:

The performance of tests and the revision of the automated control system software;

Reporting, storing and entering changes in the programs and documentation;

Reproduction and quality control of the automated control system programs on machine carriers;

Editing and publication of the program documentation;

Preparation and publication of advertising and information materials on the automated control system software;

Experimental introduction of the software in the automated control system.

The "Tsentrprogrammsistem" Scientific Production Association provides the following forms of services to the users:

Provision with information materials;

Transmission of the software;

Follow-up of the software;

Training of specialists of the user organizations.

All of the operations performed by the "Tsentrprogrammsistem" Scientific Production Association are performed in accordance with two-way agreements.

In 1979 the "Tsentrprogrammsistem" Scientific Production Association delivered more than 2000 software items on order to 600 organizations of the country; more than 1000 specialists of the user organizations were trained in the association in the application of the software in the automated control system.

The revision and modification of the automated control system software are needed to maintain the software in its intended condition. Three basic types of operations are distinguished with respect to maintaining the automated control system software:

1. Elimination of errors in the software. These errors are discovered after experimental introduction and also during mass introduction at various enterprises and organizations of the country.

2. The modification and complete reproduction of the software. During introduction the software is modified to adapt it to the changing conditions of the environment within which the programs function (the hardware, the operating systems, the data processing methods, and so on) and also to expand the functions of the basic algorithm, to improve the time characteristics of the operation of the programs, and so on.

3. Adaptation (generation) of the software for the conditions of its specific application. As a result, working programs are created which execute defined control functions in the specific automated control system.

The labor consumption of the follow-up of the software over a period of 4 or 5 years of active application of it in the automated control system reaches the cost of development, and in a number of cases, significantly exceeds it.

The primary reason for the high labor consumption of the follow-up operations lies in the low technological nature of the automated control system software develc'ments for the TsFAP. The automated control system software basically is created in unstructured code using the logical transfer operator "GOTO."

The programmer engaged in follow-up, as a rule, is not the author of the specific applied program of the automated control system. In order to revise and modify the applied program of the automated control system, the programmer must understand it on the level of the initial text; he must thoroughly analyze the program, instruction by instruction, and make his own remarks (comments) on the revisions which must be introduced into the programs, recompile the program, edit it and check out the new version.

The uncontrolled application of the "GOTO" transfer instruction is the greatest obstacle to understanding (readability) the applied program of the automated control system. In addition, the "GOTO" operator is the basic source (more than 50%) of all errors in the program when programming automated control system problems.

Accordingly, the problems of the technological nature and quality of the software developments for automated control systems based on the application of modern programming technology are acquiring primary significance of the organization of the centralized follow-up of the automated control system software.

The modern program technology is based on a number of methods, when taken together make it possible to provide for the development of the automated control system programs in the form of software. In our opinion it is meaningful to consider modular programming, the method of modular construction of the programs, and the principle of developing the "top-to-bottom" programming systems basic.

From the point of view of programming technology, as the process of forming the software, the application of the principles of modular programming will offer broad possibilities for obtaining maintainable and modifiable programs, providing unified methods of creating, checking and revising the algorithms. The primary advantage of modular programming is the possibility of forming the "interface" between the program developers and the specialists dealing with the problems of following up the programs.

The work on program technology is being done in the country within the framework of a long-range program with the participation of the majority of leading organizations. The program includes the development and introduction of the methodology of programming and designing software and the tools supporting it. When developing the work program, consideration was given to the necessity for generalizing the results of introducing programming technology under various conditions and more precisely defining the individual principles of the methodology on the basis of this, and also the modification or development of new tools. For this purpose the work program is being executed in several steps.

The primary goal of developing software in the first step is equipment of the programmer with tools permitting efficient and effective construction of the technological process of producing the software product.

For the technological support of the work of the programmer, the software performs the following functions:

Input of the initial texts of the programs and placement of them in the library of initial modules;

Checking of the initial texts for correctness of formation in accordance with the accepted norms;

Editing and modification of the initial texts of the programs in accordance with the accepted rules;

Editing of the initial program texts by standard elements from the support library;

Compilation of the initial program texts to obtain objective codes with output of diagnostic reports about errors;

Automatic inclusion of the "sensors" in the program that are needed to obtain intermediate analysis results during checkout and assembly of the required information about the course of the execution of the program for design control;

Provision for the dialog mode of debugging control;

The generation of debugging data;

The loading and control running of the programs with output of diagnostic information about the course of execution of the programs and the state of the variables;

Accumulation of statistics with respect to debugging and the formation of information about the state of the debugged programs;

Formation and output of information about the state of development of the design;

Preparation of the "Initial program texts" documents using a computer.

The adopted architecture of the system makes it possible to realize step-by-step introduction of the process elements and to expand the set of functions performed by the tools.

The development of the programmer tools within the framework of the first step of the work program with respect to programming technology coincides with respect to general ideology to a great extent with the functions of the LIBRARIAN, METACOBOL, ROSCOE, AUTOFLOW II packages, although ASSEMBLER and PL/I were adopted as the basic programmer languages.

One of the basic areas of development of the process within the framework of the second step is determination of the requirements on the final product and the documentation for it, that is, the problems with respect to the following items will be resolved:

The creation of basic standards for the programs coming into the TsFAP;

Determination of the quality criteria of the software production;

Improvement of the methods of testing the programs;

More precise definition of the requirements on the content of the program documents.

The tools developed in this step are oriented toward insuring optimal conditions for introduction of the standard into the final software products.

The purpose of the third step is to create optimal working conditions for the programmer when developing the programs and the documents for them. This can be achieved by separating the operations connected with creating the program and the operations pertaining only to its operation and maintenance, that is, the separation of the "programmer machine." The functions of this machine must be:

Cataloging the program text;

Correction of the program text;

Inclusion of standard modules in the text;

Checking out the program text for correspondence to the standards;

Filling out the documents for the programs;

Preparation of the assignment packages for execution on the basic computer;

Receiving and outputting the program execution results.

In our opinion, the most efficient will be to assign a small computer (SM EVM) as the "programmer machine" and a computer from the unified system of electronic computers (YeS EVM) as the basic computer.

The development of this type of technological process with the corresponding tools (the work area of the programmer) presupposes the solution of the problems connected with data transmission from the small computer (SM EVM) to the integrated computer (YeS) and the reverse, dispatching of such a process, the use of one information base for formation, storage and transmission of all of the necessary information on the process of developing programs on the YeS EVM computer.

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SYSTEM FOR AUTOMATION OF THE DESIGN OF AUTOMATED CONTROL SYSTEMS BASED ON THE GENERAL-SYSTEMS PACKAGES OF APPLIED PROGRAMS FOR AUTOMATED CONTROL SYSTEMS

USSR CONFERENCE PAPERS in Russian

[Article by L. G. Strel'tsova, Department Head]

[Excerpts] The "Tver'-YeS" software system is a universal set of tools for automating the programming of problem-independent data processing systems, and it offers the user the possibility of creating and processing an information base of complex structure in the form of a set of linear files (files with independent uniform records) and data bases of universal structure controlled by the "BANK" system, making use of unified means both in working with the data bases and in working the linear files.

The system is organized in the form of a set of functionally complete components which makes it possible to use the required components in any combinations. The selection of different languages and software for the creation of the data processing system in each specific case is based on the class of problems to be solved.

The data bases supported by the "BANK-OS" system can have the network structure of the data, and they are the most universal with respect to structure

The structure of the intracomputer information base, once described, is entered in the computer memory by the "automated control system information base" software system, and it is stored permanently on a direct-access magnetic disc for future use.

The system for handling the information base of the "automated control system information base" software system only functions in the package mode, at the same time as it is frequently necessary to have direct access to the information base. In this sense the "Baza-Terminal [Base-Terminal]" software system, which organizes access to the information base in the interactive mode, is a further development of the "automated control system information base" software system.

The formation of the local information base for specific problems of a data processing system from the units of the information base consisting of universal-structure data bases and files of sequential and index-sequential organization, with simultaneous execution of a number of data processing procedures produces the component called the "Tver'-Interfeys [Tver' Interface]" software system. The "Tver'-Interfeys" software system also provides for entering the data contained in the data files which are output for the specific problems of the data processing system, in the collections of the integrated information base. Thus, when using the "Tver'-Interfeys" software system the problem is completely "separated" from the information base, which above everything else, promotes integralness and reliability of the base.

Although in general the "Tver'-Interfeys" software system is an interpreting type system, during the functioning of the system program modules are generated for the performance of the arithmetic and logical operations themselves, which the programs reference when organizing the execution of the operations of the "Tver'-Interfeys" software system. This procedure makes it possible to reduce the expenditures of time on the required processing of the data files.

One of the components of the "Tver'-YeS" software system is the "PROZA[1]" software system, which is a system of languages and tools for the automation of the programming of data processing problems. It permits automatic creation of the problem programs based on the formalized description of the statements of the problems without the traditional programming step. The "SMO-PROZA" is oriented to the needs of the people stating the problems of data processing systems, systems analysists and economists.

The language for statement of the problems permits the user to describe the problem statement in formalized form in natural terms of the given problem area -- in terms of indexes and documents. Programming skills are not required of the user, for the statement of the problem (the mathematical-economical essence) is described and not the program for the problem.

The PROZA language also permits description of a control example of the problem on the basis of which the "SMO-PROZA" software system creates the corresponding input data files and permits the user to check out the fitness of the program on them.

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[1] [From the Russian words PROgrammirovaniye [programming] ZAdacha [problem]].

DEVELOPMENT OF A SYSTEM OF GENERAL-PURPOSE SOFTWARE PACKAGES (IN THE EXAMPLE OF THE "SPO-ZAPROS" SOFTWARE SYSTEM)

USSR CONFERENCE PAPERS in Russian

[Unsigned Article]

[Text] The analysis of modern automated control systems both with respect to content and design methods and means indicates that the most important problem in creating the software for an automated control system is the development of the set of means for automating the design of the data processing system.

Today there are two basic approaches to the automation of the design of automated control systems:

The development of problem-oriented means of designing the automated control system;

The development of request-oriented means -- general-purpose PPP [packages of applied programs].

The functional-purpose packages of applied programs serve as an example of the first approach (PPP-ISUP [the package of applied programs of the information system for production control], PPP-SOSP, the MAK-RASK, and so on).

The advantage of packages of this type is the presence of finished algorithmic program solutions suitable for the creation of automated control systems for a defined class of processes. However, the restrictions on the composition of the problems and class of objects of control are the disadvantage of this approach.

The second approach -- the use of request-oriented means -- removes the restrictions on the area of their application. This offers the possibility of realizing multiple versions of the control systems, in contrast to the problem-oriented means based on using predefined mathematical economic models. The essence of this area consists in creating means which can be used to describe the control of production processes in terms understandable to the person stating the problems. However, in this case the algorithmic solutions

must be developed entirely by the user. The experience in using the well-known foreign software of this type (MARK-IV, PPOTEE) indicates the high efficiency of this approach.

Recently, the development of the request-oriented systems has proceeded along the path of integrating them with problem-oriented software and the creation of complex design automation systems based on them.

One of the projects in this area is the development of the SAPR [automated design system] automated control system at the Lenelektronmash Scientific Production Association, which is based on the problem-oriented software SPO-Problema and the SPO-Zapros general-purpose package system.

In the "Zapros" software the following have been created and are in operation:

The separate file and data base loading and updating generator (GZO);

This generator provides for loading and requested updating of the data base controlled by the "OKA" SUBD [system for control of data bases] and separate files from the primary documents of the enterprise. In addition, it provides various types of nonstandard processing of the input requests and output of data from the base;

It permits a 40% reduction in the labor consumption of creating the data base at the enterprise;

A language for joint processing of files LPF which uses the set-theory data processing operations and is a version of the language of relational algebra.

It offers the possibility of joint processing of up to three base and retrieval files and (or) segments of the "OKA" data base. It increases the productivity of labor by the programmers by 50-60%:

A generator of responses based on the data dictionary (GOSD). It provides for printing out tabulagrams from the previously generated file by inputting an elementary request. The configuration of the responses is formed automatically from the information in the data dictionary which is compiled as a whole for the entire system. It also reduces the print program development time by 60%.

Taken together, the indicated means insure a sharp increase in productivity of labor in design and they lower the requirements on the programmer's qualifications.
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COMPUTER METHODS FOR LINEAR ALGEBRA

Novosibirsk VYCHISLITEL'NYYE METODY LINEYNOY ALGEBRY (Computer Methods for Linear Algebra) in Russian 1978 signed to press 4 Dec 78 pp 33-4

[Table of Contents and Foreword from the collection edited by G. I. Marchuk, Vychislitel'nyy Tsentr AN SSSR, 500 copies]

[Text] The collection was prepared on the basis of reports given at the seminar "Methods of Computer and Applied Mathematics" of the Computer Center of the Siberian Department of the USSR Academy of Sciences in 1978 and related to problems of computer methods of linear algebra.

The theme of the collection is rather diverse. The report of Professor R. S. Varga from Kent State University was devoted to a survey of some of the latest results in the field of numerical algebra and its applications. A new approach to study of stability criteria of systems of ordinary differential equations is considered in the paper of A. Ya. Bulgakov and S. K. Godunov. Application of two-step iteration methods to solution of problems for eigen-values is discussed in Ye. G. D'yakonov's paper. The paper of Yu. A. Kuznetsov and A. M. Matsokin is devoted to developing methods of partial solution of systems of linear algebraic equations and their application to solution of problems of mathematical physics. The problem of calculating generalized normal solutions and pseudo-inverse matrices is studied in the papers of S. Dzhumayev, S. M. Bersenev and Sh. Khodzhiyev.

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UDC 658.5.011.56(474.5)

RESERVES AND METHODS FOR INCREASING THE ECONOMIC EFFECTIVENESS OF AUTOMATED CONTROL SYSTEMS IN THE INDUSTRY OF THE REPUBLIC, PART 1

Vilnius REZERVY I PUTI POVYSHENIYA EKONOMICHESKOY EFFEKTIVNOSTI AVTOMATIZIROVANNYKH SISTEM UPRAVLENIYA V PROMYSHLENNOSTI RESPUBLIKI. I CHAST' in Russian 1979 signed to press 31 Jul 79 pp 2-5, 32-34, 61-62, 78-79, 80, 87, 90-93, 97, 102, 103, 104, 117-121, 123, 124

[Excerpts from the collection "Rezervy i puti povysheniya ekonomicheskoy effectivnosti avtomatizirovannykh sistem upravleniya v promyshlennosti respubliki. I chast'," Institute of Economics of the Lithuanian SSR Academy of Sciences, Scientific Research Institute of Economics and Planning of the National Economy of Gosplan of the Lithuanian SSR and the Lithuanian Republic Administration of the Scientific and Technical Society of the Instrument Building Industry imeni Academician S. I. Vavilov, Lithanian NIINTI, 370 copies, 237 pages]

[Text] The collection includes the report topics of the republic conference devoted to problems of increasing the economic effectiveness of ASU in the industry of the Lithuanian SSR. The topics consider the theoretical and practical problems of determining and increasing economic effectiveness and reserves for improvement of existing ASU. The second part of the report topics "Improving the Planning of the National Economy With Functioning of ASU" is devoted to some planning problems, the use of economic-mathematical methods and the use of computer technology. It was prepared with the participation of the Council of Young Scientists of NIIEP [Scientific Research Institute of Economics and Planning of Gosplan of the Lithuanian SSR.

The collection is intended for scientific workers, engineering and technical personnel, designers and practitioner workers in the field of development, use and operation of ASU.

The editorial board is B. Blazhis, Ch. Demida, A. Chepele and R. Yusionis.

Organizing Committee of the Conference

B. Blazhis--chairman, deputy director of the Institute of Economics of the Lithuanian SSR Academy of Sciences, candidate of economic sciences.

A. Chepele--deputy chairman, deputy director of NIIEP of Gosplan of the Lithuanian SSR, candidate of economic sciences.

V. Kyaras--secretary, senior scientific associate of the Institute of Economics of the Lithuanian SSR Academy of Sciences, candidate of technical sciences.

V. Paura--member, senior engineer of the Department of Computer Technology and Improvement of Management of Gosplan of the Lithuanian SSR.

R. Yusionis--member, senior scientific associate of the Institute of Economics of the Lithuanian SSR Academy of Sciences, candidate of economic sciences.

A. Machernyus--member, chief of the ASU Department of the Vilnius Production Association Sigma, candidate of economic sciences.

A. Baskas--member, section supervisor of the Institute of Mathematics and Cybernetics of the Lithuanian SSR Academy of Sciences, candidate of technical sciences.

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Using the indicator of the average daily computer load for calculation and analysis of computer and computer center operation does not contribute to an increase of the productivity of computer and computer center operation. For example, modern computers can operate both in single- and multiprogram modes. During operation in the multiprogram mode, computer productivity is increased 1.5-2-fold, but the average daily computer load decreases by the same amount. This version is not advantageous for computer centers since many of the computer centers of the republic barely contain the established norms of the average daily computer load.

Computer productivity depends largely on the software system. Improvement of software and the use of machine-oriented language permits an increase of computer productivity, but there are no material stimuli for performing the given work with the existing analysis of computer center operation.

The computer is frequently used to perform operations which it is far less expensive to perform on keypunches or perforation machines. Because of this, and also due to a number of other factors, a situation is frequently created in which, regardless of how paradoxical this is, computer processing of accounting-economic information requires greater labor and material expenditures than processing it by traditional methods. This can be proved by using simple calculations and cursory inspection and the reports of computer center operation in the Lithuanian SSR during the second half of 1978.

At many computer centers, 3-4 persons are engaged on the computer in preparation of the technical information carriers for computers, which corresponds to the standard set of data preparation equipment. For example, the main composition of the YeS-1022 model contains two data preparation devices on punch cards and one device on punch tape. With an average engagement factor of a model of 60 columns, the operator punches approximately 100 cards per hour and 17,000 cards per month. Three operators punch 51,000 cards. With an average working time of 450 hours (30 X 15) per month, the computer processes 113 punch cards per hour. With the cost of a machine-hour of 80 rubles, the cost of processing one byte of information comprises more than one kopeck, while productivity comprises two bytes per second.

Even for optimization problems where approximately 1,000 operations per byte of operation are required, the computer can be loaded only by 20 percent with this amount of information: $(2 \cdot 1{,}000 \cdot 100)/11{,}800 \times 17$ percent, where 11,800 is the productivity of the YeS-1020 according to Gibson.

The pattern will be even less suitable if the calculation is made for accounting-planning problems or so-called "direct accounting" problems which comprise the main fraction of problems being solved.

Some specialists may object that the information processing time is distinguished as a function of the type of problem. Actually, problems which use complex economic-mathematical methods, for example, problems of optimization and modelling, require several times more operations per unit of information compared to accounting-planning problems or as they are called, direct accounting problems. But those problems, as indicated by analysis, solved in the ASU of our republic and of the country comprise a very small percent. For example, even for higher level SU--the OASU of ministries and agencies of our republic, these problems comprise only two percent of all the problems solved. This same pattern is also observed in the structure of the problems of the ASUP (Automated system of control of an enterprise) of enterprises.

If one takes into account that optimization and modelling problems are usually solved only once every quarter or once annually, then solution of these problems occupies an even smaller percentage of time at the computer center. For a number of objective reasons and in the future, direct accounting problems will comprise the main computer load at ASU and the effectiveness of solving them will largely determine the operating efficiency of the computer centers.

An insufficient computer load, low volumes of processed information and nonconformity between the needs for computer capacities and the acquired equipment inflict a great loss on the national economy. Introduction of the index of the volume of processed information will make it possible to obtain a more objective pattern for evaluation and comparative analysis of computer center operation.

Without touching on problems of development and production of modern computer equipment (VT), one must note the frequent lack of justification of VT distribution throughout economic objects of the republic, the low organizational level of computer center activity and the clear deficiencies in the complex of computers and peripheral support of ASUP. Thus, the new computers coming in are sent to economic objects unprepared to introduce and operate them (the absence of specially equipped rooms, the shortage and lack of training of personnel and so on), as a result of which the VT is not put into operation on time and frequently stands idle due to a number of universal factors.

The composition of computer centers is also inadequate. Computers of the unified system (YeS EVM) installed at computer centers are provided with only a minimum set of basic devices; therefore, even powerful YeS EVM cannot guarantee high reliability and uninterrupted operation of the computer centers because of frequent idle times due to technical reasons: failure of one of the devices interrupts the operation of the entire computer. The presence of two or three computers of different types at the computer

center does not help the situation because of program incompatibility and technical non-interchangeability of machines and individual devices, which is specifically related to the YeS EVM.

In 1978, the computers at all computer centers of Lithuanian industry stood idle for 13,462 hours (5.2 percent of the total actual operating time) for technical reasons. This indicates significant nonuniform operation of the computer centers and severely complicates the functioning of such ASUP subsystems as "Operational control," "Control of technical preparation of production," "Control of MTS" and so on. Nonuniform operation of computer centers is especially discernible for clear functioning of ASUTP [Automated System of Control of Technological Processes].

The inadequate efficiency of ASUP determines to a significant degree the absence of peripheral devices (production recorders, modems, user stations and so on), which makes it difficult for the ASUP to function in real time, hinders operational exchange of information and makes the entire system less flexible and sensitive to changes in the control object.

According to data of TsSU [Central Statistical Administration] on 1 Jan 1978, there were 23 computer centers operating in the industry of the republic, the average annual cost of the basic production funds of which comprised approximately 16 million rubles. Various computers and peripheral equipment comprise the technical base of these computer centers. The annual saving from introduction of computer technology comprises 3.4 million rubles.

However, the effectiveness of using expensive computer technology in different ministries and at enterprises still remains at a low level. Whereas the average annual load fluctuates mainly in the range of 12-16 hours for computers of type Ruta-110 and Minsk-22 and Minsk-32, it comprises 4-6 hours for the YeS EVM.

Obviously, this situation was created mainly due to the fact that there is no competent body in the republic which coordinates the activity of all computer centers in the field of unified software of complexes of problems being solved. On the other hand, the rapid growth of the number of computer centers creates specific difficulties in providing them with qualified specialists, specifically, programmers and other computer maintenance personnel.

Automated data banks (ABD) will be developed at the republic computer centers of the Estonian SSR, the republic computer centers of the TsSU of the Belorussian SSR, the computer center of Tul'skaya Oblast and the main computer center of TsSU of the USSR as an experiment in 1980. Introduction of ABD at all computer centers of TsSU of the USSR is planned during the 11th Five-Year Plan. During the next five-year plan, it is also planned to convert information transmission from commutated to uncommutated communications channels, i.e., to a remote statistical information processing system (STOSI).

1. Definite experience in effective design and introduction of ASU and computer centers and also some experience of developing multiple user (KVTs) and territorial time-sharing computer centers (VTsKP) have now been accumulated and the prospects of further development of them are being considered. There are 3,500 ASU of various designations, including more than 2,500 ASU in industry, among which are more than 1,100 ASU of enterprises used to solve 350 classes of various problems in 60 sectors (there were 50 classes in seven sectors five years ago), functioning in the country.

2. The accumulated experience indicates the high effectiveness of automated control systems and primarily of ASU developed in industry. The period of return of funds invested in development of ASU does not usually exceed 3-3.5 years, while ASUTP are usually paid for in practically 1-2 years.

6. The experience of VTsKP design is further outlined in the report. The essence of this experiment briefly reduces to the following. Seven experimental VTsKP--four VTsKP based on the computer center of the TsSU of the USSR (at Tomsk, Tallin, Minsk and Tula), one based on the Main Computer Center of Gosplan of the Latvian SSR (at Riga), one based on the Computer Center of Lengorsistemotekhnika (at Leningrad) and one based on the Computer Center of Glavtyumen'neftegazstroy [Main Tyumen' Administration for the Construction of Petroleum and Gas Industry Enterprises] (at Tyumen') --are now being designed. Two YeS-1033 computers have been selected as the technical base (except for the VTsKP of Riga). This is related to the fact that our industry does not now produce high-speed computers. Development of the indicated VTsKP permits one to accumulate experience and to turn to design of higher capacity VTsKP. One of these powerful VTsKP will be developed during the 11th Five-Year Plan at Tashkent on the basis of the Main Computer Center of Gosplan of the Uzbek SSR. It is assumed that this VTsKP will initially be supplied with two YeS-1060 computers. The GKNT [State Committee for Science and Technology] of the USSR is now working on selection of 45-50 computer centers on the basis of which the developed programs for creation of VTsKP will be accomplished during the 11th Five-Year Plan.

8. The reporters advance and independently consider the following advantages of GSVTs [State Network of Computer Centers]. The first is a significant reduction of the one-time capital investments for development of ASU and current operating expenses and also a sharp increase of the technical and economic indicators of enterprise, organization and institution operation. The second is reduction of specific expenditures for development of control systems, for which typical design practice can be widely distributed. The third is a reduction of expenditures for use of ASU hardware, especially when converting to a new series of YeS EVM (1978-1982), the average cost of processing a unit of information on which is 2.5 times less than that on existing computers of the unified system.

It is stated in the report that the fraction of expenditures for design of ASU will be reduced as the front of operations is expanded, the fraction for acquisition of computer facilities will increase and the fraction of expenditures for acquisition of programming devices and operation of computers will increase at the next stage. It is expected that specific expenditures for design while retaining the existing order of developments in the foreseeable future will be reduced to 40-50 percent of their current volume and will be reduced to 25-30 percent of this volume upon development of GSVTs. Specific expenditures for acquisition of hardware will decrease more slowly and will possibly even increase for some items (programs, data transmission equipment, information carriers and terminals). But on the whole the expenditures for processing a unit of information will be reduced significantly. A very discernible saving can also be achieved as a result of different organizational changes related to development of GSVTs.

On the whole, specific expenditures for automated information processing as a result of GSVTs introduction should be reduced by a factor of at least 2.5. It is easy to understand what a large saving this will provide on scales of the national economy as a whole. The volume of processed information now comprises approximately 10^{16} operations (calculated for machine operations). The annual increase of the volumes of processed information may comprise 5.2-8.3 percent in the forseeable future. An average of 70-80 percent of all information processing operations in management bodies can be automated.

It is also stated that with development of the GSVTs, it will be possible to reduce significantly the volume of information processed in solution of the current range of problems. It is known that even during the first stages of ASU introduction, the volume of information is reduced by 20-30 percent with proper organization of matters.

In our republic (according to data of the Institute of Economics of the Lithuanian SSR Academy of Sciences), solutions of problems on automated product quality control occupies a very insignificant position (only 2-7 percent) among the ASU functioning at republic enterprises. Moreover, there is no single operating automated control system in the republic which would solve problems of product quality control during manufacture. Therefore, solution of the problem of product quality control using ASU would permit the use of reserves for increasing the effectiveness of ASU in the industry of the republic.

The experience of developing the ASU of the Ministry of Construction shows that the actual economic effect of the ASU is approximately 30 percent less than the calculated value.

The main reasons for reducing the efficiency of ASU functioning can be reduced to three main groups: the first are factors which characterize the collective of ASU developers (qualifications, stimulation of their labor, the organizational structure of the ASU subdivisions and so on), the second

are factors which characterize the level of training of ASU customers (the role of the first manager, the qualifications and degree of participation of customer services in design and introduction of the ASU, the level of organization of production and labor and so on) and the third are external factors independent of the developers and customers of ASU (the level of hardware development and so on).

The generalizing factors of ASU efficiency as a whole or of separate subsystems are the quality of the design solutions and the scientific and technical level of the ASU.

It is generally known that ASU quality is formulated at all stages of its development: the preparatory stage, the pre-planning stage (improvement of the existing management system of a construction organization, technical and economic justification of ASU development and compilation of the technical assignment), the contract and detailed designs and experimental and industrial operation of the ASU.

The contribution and measure of responsibility of customers and developers for the quality of ASU developments are different at individual stages of development.

The fraction of responsibility for the quality and efficiency of ASU is distributed in the following manner in the opinion of 60 expert specialists and supervisory workers of the Ministry of Construction of the Lithuanian SSR:

Executors	Stages of ASU Development and Fraction of Executor Responsibility (of 100 percent)					
	Pre-Planning Stage					
	Suggestions to Improve Existing Control Systems	Technical Assignment	Contract Design	Detail Design	Experimental Introduction	Operation
1. ASU Developer (Operating Computer Center)	46	60	94	93	71	84
2. Customer (Construction Organization)	54	40	6	7	29	16
	100%	100%	100%	100%	100%	100%

Although the opinion of experts is subjective in nature to one or another extent, the accumulated 10 years of experience in organizing the development of ASU in the construction sector of the republic permits one to make the following conclusions:

1. The customer should assume a comparatively high fraction of responsibility during the pre-planning stage of ASU development and the developer should assume it during the remaining stages.

2. Development of the scientific and technical level of the ASU place increasing requirements and responsibility on the scientific manager, the chief designer and managers for the quality of the design developments: the prospects, completeness, reality and improvement of the design solutions during operation of the ASU.

3. The need for managers of ASU development to assimilate the knowledge of a number of fields of science (construction technology, organization and economics, systems engineering, mathematical methods, programming and ASU hardware) in development and introduction of ASU is advanced as of special importance in selection, training and education of specialist personnel of managers of ASU development.

4. Scientific developments must be worked out to determine methods and criteria for evaluating the quality of the design solutions of ASU.

5. The measure of responsibility of ASU customers and developers can be regulated by legal documents.

Design of an automated control system for a sector of industry was begun for the Ministry of the Food Industry of the Lithuanian SSR (OASU-Litminpishcheprom) at the end of 1972 to increase the effectiveness of controlling the planning department of the food industry and introducing the ASU of the Planning and Design Office.

After the YeS-1020 computer was put into operation in 1976, the first unit of the OASU containing three subsystems--operational control, technical-economic planning and bookkeeping--was turned over for industrial operation. Eight subsystems and more than 60 problems are now being operated. The problems are solved mainly for the Central Management Apparatus of the Ministry of the Food Industry (MPP) of the republic, partially for the main computer center and the administrative apparatus of MPP of the USSR and in some cases for enterprises. More than 200 machine-grams of various type are issued as a result and more than 2,000 machine-grams are issued annually. It is planned to introduce the second unit of the OASU consisting of six subsystems in 1980. Thus, the OASU-Litminpishcheprom comprises nine subsystems and more than 90 problems and their complexes.

The OASU-Litminpishcheprom provides mechanization of the following control functions of the ministry apparatus:

--gathering, processing and transmission of operational data on fulfillment of the plan by the main production and economic indicators, fulfillment of the plan for loading railroad cars and freight, procurement of raw agricultural products and so on to the appropriate departments of the ministry and the main computer center of MPP of the USSR;

--a check and summary by subsectors and the ministry of the forms of statistical reporting for bookkeeping, financial activity, supply and labor;

--calculation of needs for raw foods;

--presentation of data on analysis of fulfillment of the plan of the cost of commercial products, profits, expenditure of the wage fund and an increase of production to the appropriate departments of the ministry;

--monitoring the course of fulfilling the orders and commissions of superior organizations, introduction of measures of new technology and new products, the movement of multicirculating tare and so on.

Analysis of the solved problems showed that 36 percent of them are related to the group of problems on the summary of statistical accounting, 35 percent are related to the group of analysis problems, 24 percent are related to the group of operational problems and 5 percent are related to the group of planning problems. The complex of problems on optimum planning of production of the confectionery subsector is at the stage of development and experimental operation.

Being guided by the sector method of determining the economic effectiveness of an ASU, calculations of the anticipated economic effect were made. It comprised 210,000 rubles annually for the first unit of the OASU (320,000 rubles for development) and 300,000 rubles annually for the second unit (500,000 rubles for development with regard to improving the first unit). The theoretical recovery of the OASU (taking into account the expenditures for operation and capital investments) comprises 2.9 years for the first unit and 2 years for the second unit, respectively. Calculations for determining the actual economic effect were not made for the first unit of the OASU during 1976-1978, since this was not provided by the method of determining the economic effect.

Workers of the computer center of the ministry made some calculations to determine the actual effect of the OASU on the operation of the management apparatus of the ministry. For example, a reserve of working time for the workers of six departments of the republic ministry, which comprises approximately 460 man-days annually, was created with regard to the automated solution of 11 problems for the main computer center of Minpishcheprom of the USSR. Automation of the summary of annually, quarterly and monthly bookkeeping releases to a specific degree workers of the bookkeeping

department and the department of agency control (provisionally, one person annually). The annual and quarterly report using computers is compiled two to three times more quickly, the calculations are more reliable and at the same time an information base in the computer memory is created for solving analysis problems. The subsystem for gathering and checking data on the course of procurement of raw agricultural products using teletype communications and computers releases all the workers (four persons) of the department of raw agricultural products and procurement from laborious work (telephone communications) over a period of five months for 3-4 hours daily. The load of many workers of the ministry with cumbersome calculations of the need for raw material and materials and calculations of the average norms of basic raw material and material consumption has been eliminated. Monitoring the execution of commissions and orders of superior organizations and of the government, monitoring the introduction of measures of new technology and new products, the movement of multicirculating tare, production and sales of goods of increased demand and so on has been brought into order.

All the outlying facts reflect only part of the real effect. A large fraction of the effect of the OASU on control is not subject to determination since the effect of the management apparatus of the ministry itself on production is indirect in nature.

In generalizing, one can state that no increase in the needs of the management personnel of the ministry was observed during the period 1976-1978 under conditions of OASU functioning and with an increase of production volumes, but on the other hand a reserve of working time was created for workers of the management apparatus. However, we have not yet managed to achieve an actual positive economic effect in the monetary sense both from realization of individual subsystems on the computer and from the entire system. Only the effect of reducing labor expenditures has been determined in some cases.

A number of diverse factors determines the insufficient economic effectiveness of the OASU-Litminpishcheprom.

1. The OASU does not fully encompass the functions of the management apparatus of the ministry either in the volume of the first unit or that of the second unit both in the information and in the management aspect and is incapable of being adapted under rapidly changeable conditions.

2. Direct accounting problems are mainly presented to the OASU. A large percentage (71 percent) of the introduced problems is related to the group of summary and analysis problems which are required for development and introduction of more complex problems (using mathematical methods), but cannot yield a significant economic effect.

3. Introduction of the OASU essentially did not influence improvement of the management structure of industry.

4. There is a shortage of standard problems and program solutions with regard to which original, laborious and expensive developments were carried out.

5. The technical level of production of the food industry is comparatively low, which results in imprecise accounting of production and technology.

6. The customer participates insufficiently during development of the system.

The main part of expenditures (60-70 percent) for development and introduction of ASU is expenditures for general systems development. The laboriousness of general systems developments decreased by 70 percent by the end of the Ninth Five-Year Plan (compared to 1970), the average laboriousness of problem development decreased by 30 percent, including 10 percent at the stage of postulation of the problem and 40 percent at the programming stage.

The fact that the average cost of development of a problem has increased 1.5-fold during the 10th Five-Year Plan due to complication of postulation of problems and the search for adequate economic-mathematical models should be noted.
[251-6521]

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RESERVES AND WAYS TO INCREASE THE ECONOMIC EFFECTIVENESS OF AUTOMATED CONTROL SYSTEMS IN THE INDUSTRY OF LITHUANIA. PART 2

Vilnius RESERVY I PUTI POVYSHENIYA EKONOMICHESKOY EFFEKTIVNOSTI AVTOMATIZIROVANNYKH SISTEM UPRAVLENIYA V PROMYSHLENNOSTI RESPUBLIKI. II CHAST' in Russian 1979 signed to press 31 Jul 79 pp 6-7, 11, 12-13, 45-46

[Table of contents and excerpts from summaries of reports presented at the scientific and technical conference of the republic. Edited by R. Yusioniz, Institute of Economics of the Lithuanian SSR Academy of Sciences, Scientific Research Institute of Economics and Planning of the Lithuanian SSR Gosplan and the Lithuanian Republic Board of the Scientific and Technical Society of the Instrument-Making Industry imeni Academician S. I. Vavilov, Vilnius, 370 copies, 76 pages]

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In recent years in our country work has been expanded on the creation of sutomated control systems. In the national economy of the Lithuanian SSR 3426 ASU were put in operation in the period 1966-1977. In 1978 alone 400 more ASU were created, including 260 automated systems for the control of technological processes.

On the whole the technology exists, the personnel have been trained and enormous resources have been expended (in 1978 alone 3.3 billion rubles on computer technology and spare parts, but the desired effect has not yet been obtained. What are the reasons for such a situation?

Firstly, an absence of stimuli for the introduction of economic mathematical methods and computer technology (and systems of of state importance cannot be constructed only on the enthusiasm of individual workers of the planning agencies) and a sufficiently developed methodology of planning under the conditions of automated systems creation.

Secondly, there are imperfect approaches to ASU creation. In the creation of ASU an attempt is made to solve the same problems as without electronic computer technology. The problems are solved in the best case in package conditions, but usually each problem is solved separately. The users themselves are separate from the systems, but the departmental approach to ASU creation leads to dispersion of the developers and duplication of information on certain problems.

Thirdly, the imperfection of the technology has its effect. Although electronic computers are produced and called universal, they do not take the specifics of economic data processing into account very well. When they are rapid enough, they are connected to low-capacity peripherals. The storage volume does not meet the requirements for solution of problems of the national economy and the data input and output have low capacities.

And fourthly, there are complaints about the mathematicians. Programming elements, instead of being simplified, are becoming more and more complicated and now are mastered only by highly qualified mathematician-programmers. The proposed models for planning the conomy are divorced from life in many cases. Emphasis on precise methods of solving problem leads only to overexpenditure of resources (this applies especially to optimization problmes with large dimensions).

Questions of the aggregation or separation from the entire variety of factors under the influence of which the level of labor productivity forms, factors that are the most essential (basic, significant) in the planning of

labor productivity at the present time are very little developed. The solution of these questions is very often subjective (starting from experience, professional knowledge, the level of skills or even intuition). At the same time, in the area of economic-mathematical modeling there are clear recommendations regarding their solution. For purposes of aggregation we have used algorithms of taxonomy and the theory of image recognition, known under the names of "FOREL" and "CRAB." Computations are made with standard programs in accordance with those algorithms for the YeS electronic computers [2].

This approach was used in analyzing materials on the industry of the Belorussian SSR for 1970-1976. To perform long-range calculations with consideration of the effect of the main factors, a data base was used that included 219 technical and economic indicators. As a result of aggregation the initial set was reduced to 11 indicators, from which six sets of informative factors were formed for modeling purposes. Using those sets, long-range calculations were made of the possible growth of labor productivity in 1977-1980. Comparative analysis of the obtained results, the tasks of the Tenth Five-Year Plan and the actual rates of growth of labor productivity shows high adequacy of the consolidated models: the approximation coefficient does not exceed 1 percent.
[253-2174]

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UDC 621

DATA COLLECTION AND TRANSMISSION

Kiev OTBOR I PEREDACHA INFORMATSII in Russian No 58, 1979, signed to press Aug 79, pp 2, 3, 4, 136

[Annotation, in memoriam to V. N. Mikhaylorskiy, table of contents in symposium, 1000 copies, edited by V. N. Mikhaylovskiy et al]

[Text] The symposium considers results of research and development in theory, methods and facilities for designing systems for data collection and transmission. Considerable attention is devoted to the signal and noise theory, methods for increasing the speed and authenticity of detecting and recognizing images on the noise background, the theory and methods of calculating electric circuits and data channels on computers, methods for improving the metrological qualities and raising the informational and technical efficiency of the measuring converters and systems. Brief information is given on the latest developments in the area of information -- measurement techniques.

This is intended for scientists, engineers, technicians, postgraduate and VUZ students who specialize in the theory, methods and facilities for designing systems of collecting, processing and transmitting data.

In Memoriam V. N. Mikhaylovskiy

On 13 December 1978, after a serious and long illness, Vladimir Nikolayevich Mikhaylovskiy died in his 65th year. He was a noted Soviet scientist in the area of automatic systems, telemechanics, information equipment and instrument building and a corresponding member of Ukrainian Academy of Sciences.

V. N. Mikhaylovskiy was born 15 August 1914 in Konstantinovgrad (now Krasnogard Khar'kovskaya Oblast) in a peasant family. He began to work in the Mazhevskiy Plant imeni Kirov when he was 15 years old. In 1933, he completed the Mazhevskiy Mining Worker's Faculty and entered the Moscow Power Engineering Institute. On graduating from the Institute (1939), he worked as engineer at plants.

From 1941 to 1945, inclusive, he fought on the fronts of the Great Fatherland War. In 1945, he was admitted to the party as a member.

The start of V. N. Mikhaylovskiy's scientific activity is closely related to the Institute of Automatics and Telemechanics of the AN USSR (1946-1951). His first scientific works were completed at the beginning of the fifties and dedicated to the development of new methods of automation and remote control in exploring for minerals, petroleum production and underground gasification of coal.

V. N. Mikhaylovskiy was the initiator of the wide introduction of methods and facilities of modern radio electronics in geophysical instrument building. To a considerable extent his work determined the basic trends of development of science and engineering in this area.

In the sixties, Vladimir Nikolayevich started investigating methods for converting signals and determining new possibilities for increasing the data indicators of measurement systems and devices for data transmission. He personally, and those under his guidance, developed individual sections in the theory of signals, coding and relationships between their statistical and metrological parameters.

V. N. Mikhaylovskiy was the author of over 180 scientific papers, including seven monographs and a great number of inventions. Over 25 candidates and four doctors of science were trained under his guidance. He was one of the organizers of the Physio-Mechanical Institute of the AN Ukrainian SSR. Always a sympathetic comrade, skilled teacher and trainer, Vladimir Nikolayevich devoted much attention to preparing and training scientific cadres.

V. N. Mikhaylovskiy was the founder and irreplaceable responsible editor of the interdepartmental republic "Data Collection and Transmission" symposium, and was a member of a number of commissions of the Presidium of the AN USSR and Ukraine SSR.

The long and multifaceted scientific-technical, organizational and social activity of V. N. Mikhaylovskiy was valued highly by the party and the Soviet government. He was rewarded with the "Emblem of Honor" Order, many medals and the Honor Certificate of Ukrainian SSR Presidium of the Supreme Soviet.

The bright memory of Vladimir Nikolayevich Mikhaylovskiy will always remain in our hearts.

Editorial Collegium

CONTENT

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ALL-UNION SEMINAR SCHOOL ON SIMULATION MODELLING

Kiev KIBERNETIKA in Russian No 1, 1980 p 144

[Excerpts from paper by Tamara Konstantinovna, junior research worker, Institute of Cybernetics, Ukrainian SSR Academy of Sciences, Kiev]

[Excerpt] The All-Union Seminar School on Simulation Modelling, organized by the Institute of Cybernetics of the Ukrainian SSR Academy of Sciences, was held in Kiev from 21 through 30 May 1979.

The purpose of the seminar school was to increase the scientific level of specialists which use means of machine simulation modelling in their research.

The organizing committee, headed by Academician V. M. Glushkov, included prominent scientists of the Institute of Cybernetics and other institutes and organizations of our country (VNIISI [Expansion unknown], MEI [Moscow Power Engineering Institute], VTs [Computer Center] of the USSR Academy of Sciences and others). A total of 115 representatives of 56 scientific research institutes, design bureaus, academic institutions and other organizations of 20 cities of the Soviet Union participated in the work of the seminar school.

Academician of the Ukrainian SSR academy of Sciences V. S. Mikhalevich gave the opening address.

A number of lectures was read during the seminar school.

1. V. M. Glushkov (Kiev), "The Future Trend of Development of Means of Simulation Modelling."

2. G. S. Pospelov (Moscow), "Simulation Models in Long-Term Planning."

3. Yu. P. Bocharov (Moscow), "Simulation Modelling of City Development."

4. I. N. Kovalenko (Kiev), "Some Classes of Random Processes and Their Statistical Modelling."

5. Yu. M. Yermol'yev (Kiev), "Simulation Modelling and Stochastic Programming."

6. V. V. Kalashnikov (Moscow), "Methodological Problems of Constructing Simulation Systems."

7. K. D. Zhuk (Kiev), "Methodological Support of Processes of Designing Complex Systems."

8. Yu. P. Ivanilov (Moscow), "Organization of Development of Simulation Systems."

9. Yu. G. Pollyak (Moscow), "Methodological Functions of Modelling Systems."

10. T. P. Mar'yanovich (Kiev), "The Modern Approach to Modelling on the Basis of Algorithmic Languages."

11. V. V. Litvinov (Kiev), "The Main Principles of Organizing the ALSIM-2 Modelling Complex."

12. V. P. Vinnitskiy (Kiev), "Multimachine Calculating Systems and Simulation Modelling."

13. M. A. Sakhnyuk (Kiev), "The Experience of Using a System of Modelling Analog-Digital Processes NEDIS in Sovling Applied Problems."

14. S. M. Brodi (Kiev), "Investigating Semi-Markov Processes With Discrete Interference of Case."

15. Yu. S. Sokolovskiy (Kiev), "A Method of Solving Problems of the Initial State of Design of Collective-Use Computer Systems With Direct Access."

16. A. V. Shemshur (Kiev), "Modern Modelling Languages and the Main Trends of Their Development."

The communications of 28 participants of the school, representing different organizations of our country, were heard for purposes of exchanging information on problems of using means of simulation modelling in solving various types of applied problems and for analysis of various problems which arise in the dynamics of model experiment.

Summarizing the results of the work of the All-Union Seminar School, one should note its high scientific level and also the fruitful effect which it had on the work of the specialists of the different applied fields.

The main efforts of the system developers with regard to the increasing needs for means of simulation modelling should be directed toward development of methods of modelling realized on multiprocessor computers and computer networks.

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UDC 519.713.2

PROCEEDING OF THE FIFTH INTERNATIONAL SEMINAR ON APPLIED ASPECTS OF THE THEORY OF AUTOMATA

Varna TRUDY PYATOGO MEZHDUNARODNOGO SEMINARA PO PRIKLADNYM ASPEKTAM TEORII AVTOMATOV in Russian, English, and Bulgarian Vol 1, 1979 339 pp

[From REFERATIVNYY ZHURNAL. TEKHNICHESKAYA KIBERNETIKA No 2, 1980 Abstract No 2.81.196 K]

[Text] This collection contains the materials of the Scientific Program P, "Applied Aspects of the Theory of Automata," of that International seminar, as approved by the Program Committee. The papers presented are grouped into 5 sections whose names correspond to the thematic sessions of the seminar. Vol 2 additionally contains English-language summaries of the published papers. Vol 1 deals with general problems of the synthesis of adjustable-structure automata as well as with the bases for their realization and the methods of the related synthesis. Vol 2 describes automata for parallel information processing: special-purpose processors; reliability; control; reconfiguration; and gradual degradation.

[283-1386]

UDC 681.58

MAGNETIC ELEMENTS IN AUTOMATION AND COMPUTER TECHNOLOGY

Moscow MAGNITNYYE ELEMENTY AVTOMATIKI I VYCHISLITEL'NOY TEKHNIKI in Russian, 16th All-Union Conference, Moscow, Nov 1979, Abstracts of Papers, Nauka Press 1979 320 pp

ROZENBLAT, M. A., Editor

[From REFERATIVNYY ZHURNAL. AVTOMATIKA, TELEMEKHANIKA I VYCHISLITEL'NAYA TEKHNIKA No 2, 1980 Abstract No 2 A5 K]

[Text] Summaries are presented of papers on the general problems, theory, and development of memory devices with information carriers in the form of cylindrical and flat magnetic domains on ferrite cores and thin magnetic films. A number of summaries deal with the theory and principles of the design of magnetooptical devices.

The problems considered include those of the theory and development of improved magnetic recording devices, increase in the density of data recording, in readout rate, etc. Considerable attention is paid to magnetic-semiconductor measuring, functional, and power converters, as well as to problems of research into the physics of magnetic reversal processes, new magnetic materials, and magnetic measurement techniques.

[284-1386]

CORRELATION-EXTREME SYSTEMS

TOMSK DOKLADY PERVOY VSESOYUZNOY KONFERENTSII PO KORRELYATSIONNO-EKSTREMAL'-NIM SISTEMAM 11-14 SENTYABRYA 1979 (Reports of First All-Union Conference on Correlation-Extreme Systems 11-14 September 1979) signed to press 17 May 79 pp 1; 2; 7; 8; 18-21; 103, 110; 128-129; 241-242, 243-244; 302-305; 306; 307-312; 313-317

[Excerpts from Reports of All-Union Conference on Correlation-Extreme Systems held by Ministry of Higher and Secondary Specialized Education of the USSR, Tomsk Institute of Automated Control Systems and Electronics, Scientific Council of the USSR Academy of Sciences on Traffic and Navigation Control Problems, Siberian Physicotechnical Institute imeni V. D. Kuznetsov, Committee on Adaptive Systems of the Council on Cybernetics of the USSR Academy of Sciences, Subcommittee on Correlation-Extreme Systems of the Council on Cybernetics of the USSR Academy of Sciences and the Tomsk Territorial Group of the National Committee of the USSR on Automatic Control, Izd. Tomsk University, Tomsk, 500 copies, 318 pages]

[2]

The reports included in the program of the First All-Union Conference on Correlation-Extreme Control Systems, which have become widely distributed during the past few years in automated system for the control of technological processes (ASU TP) and also in navigation and control problems of movable objects, are published in the collection.

The collection is intended for scientific workers and engineers involved in development and operation of navigation systems and ASU TP and also for students studying in cybernetics specialties. Editor--Doctor of Technical Sciences, Professor V. P. Tarasenko.

[7]

Foreword

With regard to the intensive development of the theory and practice of constructing correlation-extreme control systems (KES) based on joint use of optimum statistical methods of processing random signals and extreme control principles, a persistent need has arisen for extensive discussion and

coordination of research in this new field of science and technology. For this purpose, the first All-Union conference on the class of systems mentioned above was held from 11 through 14 September 1979 at Tomsk, in which the following participated: the Tomsk Institute of ASU [Automated Control Systems] and electronics, the Siberian Physicotechnical Institute imeni V. D. Kuznetsov attached to Tomsk State University, the Scientific Council of the USSR Academy of Sciences on Traffic and Navigation Control Problems, the Subcommittee on Correlation-Extreme Systems of the Council on Cybernetics attached to the Presidium of the USSR Academy of Sciences and the Tomsk Territorial Group of the National Committee of the USSR on Automatic Control.

All the reports may be conditionally divided into the following three groups:

1. Principles of construction and the theory of KES.

2. Applications of KES in problems of automation of production processes and navigation.

3. Problems of identification and optimization related to the theory and practice of construction of KES.

It is in this sequence that all the reports in the collection are arranged.

The conference showed that the achieved results in the field of KES indicate the great promise of using the given systems in the national economy.

[8]

Several trends can be distinguished in the theory of correlation-extreme systems (KES). Historically the trend related to engineering methods of analysis and synthesis of KES schemes of heuristic origin was the first [1-3]. Investigation was mainly limited here by quasi-steady modes in which the processes in KES are approximately equivalent to those in ordinary nonlinear follow-up systems.

The second trend was the theory of retrieval KES based on the theory of statistical solutions [3-5]. The trend of the theory of nonretrieval KES based on methods of optimum and suboptimum estimation of Kalman and non-Kalman type have been developed intensively during the past few years [6-10]. Solution of problems of synthesis in which the KES algorithms are found by the formal method to a significant degree is typical for this. The nonretrieval algorithms synthesized here, like nonretrieval KES in general, lose their convergence with sufficiently large initial deviations. The very last is the trend which combines the principles of nonretrieval and retrieval KES and accordingly optimum estimation and selection of hypotheses [11,12]. Solution of synthesis problems is also the main one here.

The purpose of the given report is a brief survey of methods of synthesis developed mainly in the second trend of the theory of KES-optimum and sub-optimum nonretrieval estimation.

[18] UDC 62-506.1

DEVELOPMENT OF THE PRINCIPLES OF CONSTRUCTION AND THE FUNDAMENTALS OF THE THEORY OF EXTREME RADIO NAVIGATION SYSTEMS

R. I. Polonnikov and V. P. Tarasenko

A cycle of investigations related to development of an essentially new class of radio navigation systems for control of mobile objects (aircraft, maritime and river vessels and ground devices) was carried out during the period from 1967 through 1978 under the scientific supervision of the authors of the present report at the Siberian Physicotechnical Institute attached to Tomsk State University and at the Tomsk Institute of Automated Control Systems and Electronics. The main idea of constructing these systems includes the following. Radio apparatus to reproduce a navigation signal (radar, rangefinder, goniometer and so on) is used on board the controlled object. This signal is compared by a selected criterion to a signal generated by an aggregate of corresponding models given with accuracy up to parameters among which includes the unknown coordinates of the object. The composition of the models is varied as a function of the type and conditions of motion of the controlled object and of the type of field used by which navigation is accomplished. Specifically, this composition may contain models of the motion of the object, of radio wave emission and propagation, of the motion of space reference points and so on. The parameters of the model are varied by means of an automatic optimizer until the comparison functional of the used and model signals reaches its own extreme value. The necessary coordinates of motion are also recorded at this moment. The cross-correlation function is most frequently used as the functional of signal comparison. Thus, the given class of navigation systems relies on joint use of correlation methods of signal processing and extreme principles of control. In this regard it has also been named correlation-extreme navigation systems (KESRN) or more briefly--extreme navigation systems.

The outlined method is the basis of developing the principles of KESRN construction which utilize the following navigation fields:

--radar maps of terrain;

--fields created by stations of hyperbolic long-range navigation systems;

--fields created by ground radio beacon signals;

--fields of signals of space reference points--artificial earth satellites.

The developed principles of constructing KESRN are oriented toward the use of various pieces of on-board computer equipment: toward the use of optical correlators in the analog version and toward the component base of integrated microelectronics and optoelectronic means of information processing in the digital version. In this case the set of required models on board the object can also be stored in different forms: in the form of corresponding subprograms of BTsVM [Large digital computer], software, in the form of reference images tied to the desired position of the controlled object and recorded on some information carriers (on photographic film, on photosensitive opto-electronic elements and so on).

Compared to known navigation systems, KESRN have the following new qualities:

1. Adaptive properties which permit efficient operation under conditions of great uncertainty of input data and variability of the situation on the earth and in the ether are inherent to KESRN on-board apparatus.

2. Signals of different sources can be processed in KESRN by means of a unified approach, which is an effective basis for making up a set of various types of navigation sensors.

The indicated new qualities permit a significant increase of the noise stability of the on-board apparatus, improvement of its accuracy characteristics by more than an order and an increase of the efficiency of utilizing ground equipment. Specifically, the KESRN which utilize natural fields, for example, radar images, are all-weather and completely self-contained, i.e., they require no ground equipment whatever. The KESRN which utilize artificial radio fields make it possible to overcome the presently existing serious difficulties of long-range navigation: expensive ground services of forecasting the radio wave propagation conditions, periodic refinement of the trajectory data (ephemerides) of artificial navigation satellites are not required for the functioning and they provide stable operation in the radio wave interference zone. An important characteristic of KESRN is their unversality. They can be used to control different objects in different conditions of motion, including control of the aircraft landing process, flight along a given trajectory at low altitudes and control of ships in the coastal navigation mode. Also important is the fact that some KESRN can be used both in the inertial navigation system correction mode and autonomously--without inertial devices.

KESRN are related to the class of statistically optimum, multidimensional, significantly nonlinear adaptive control systems. In this regard development of a number of new trends of the modern theory of automatic control and processing of information was required for their synthesis and analysis. They include:

1. Development of methods of calculating noncoherent optical correlators which permit calculation of the multidimensional cross-correlation function of compared signals in real time.

2. Synthesis of optimization algorithms of multiextreme, noisy and nonsmooth functions of many variables.

3. Development of a complex of adaptive models of radio wave emission and propagation, motion of the controlled object and of space reference points in the instability of the on-board generator of reference oscillations.

4. Development of a method of analyzing the effect of the following on the accuracy and noise stability of KESRN:

--the statistical characteristics of the navigation field used;

--the oscillations of the object during motion;

--processes of both preliminary navigation information processing (quantification by level and space and filtration) and secondary processing (elimination of the ambiguity of readings and conversion of navigation parameters to the coordinates of the object).

5. Development of methods of modelling KESRN on digital computers, which is especially important with regard to the difficulties of anlytical investigation of the given class of systems.

A large amount of digital modelling, laboratory and full-scale tests of operating mockups was carried out during investigation of different versions of KESRN. The results of these investigations confirmed the high operational characteristics and great promise of this new class of navigation systems. A number of organizations in the country has now turned to development of industrial models of KESRN.

The main results on developing the principles of construction and the bases of the theory of KESRN have been published in a large number of scientific articles (including three foreign publications) and in four monographs [1-4].

Investigations of the collectives enumerated at the beginning of the report on KESR are rather widely known to the scientific and technical community. Publications of the monographs indicated above and annual publication of the intervuz collection "Correlation-Extreme Automatic Information Processing and Control Systems" under the editorship of V. P. Tarasenko at the publishing house of Tomsk State University since 1975 and also description of the indicated papers in the first collection on the given type of systmes [5] and in the encyclopedia [6] contributed to this.

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5. Kozubovskiy, S. F., "Korrelyatsionnyye ekstremal'nyye sistemy. Spravochnik" [Correlation Extreme Systems. Reference Manual], Chapters 5 and 9, Kiev, Naukova dumka, 1973.

6. "Entsiklopediya kibernetika" [Encyclopedia of Cybernetics], Vol 1, Editorial Board of the Ukrainian Soviet Encyclopedia, Kiev, 1974.

[103]

Introduction. The distinguishing features of modern mobile equipment are expansion of the range of variation of the parameters of motion, an increase of speed and altitude and as a result of this--the continued increase of requirements on the accuracy of solving navigation problems. These requirements can be satisfied by extensive automation of the navigation information processing and development of new high-speed algorithms distinguished by high accuracy of position determination and high noise stability.

Extreme navigation systems (ESN) which combine realization of random functions and which serve to determine the coordinates of motion, have now begun to be widely distributed. On the other hand, modelling on digital computers has become a powerful, universal and comparatively inexpensive means of investigation. Therefore, the purpose of the given paper is to develop a method of digital computer modelling and illustration of the model on specific examples.

[110]

Conclusions. The described method was used to investigate ESN which utilize radar images of terrain and the signals of hyperbolic stations. The proposed method made it possible to obtain comparatively rapidly and simply the dependence of the precision characteristics of the considered ESN on variation of a number of parameters such as flight altitude and speed, the presence of bank and pitch angles, variation of the range of relative displacements, the value of measurement error dispersion of Navigation Parameters (NP) and so on.

The investigations permit one to state that the advantage of the considered method is the possibility of operational construction of models of different complexity, which permits the use of adaptive experiment methods and organization of purposeful investigation of ESN.

[128]

UDC 53.072:681.3

INVESTIGATING THE ACCURACY CHARACTERISTICS OF DIGITAL CORRELATION-EXTREME NAVIGATION SYSTEMS BY THE COMPUTER MODELLING METHOD

Yu. A. Andreyev and V. P. Tarasenko

Introduction. The correlation-extreme systems which utilize terrain images to determine the location of objects are essentially nonlinear, adaptive, multidimensional systems. There are serious difficulties of analytical investigation of them in this regard, which forces one to use methods of modelling KES on computers. One of the important advantages of these investigations is that it becomes possible in the given case to determine the main characteristics of KES using real terrain images.

The corresponding hardware and software was developed for this modelling.

The hardware includes (Figure 1) image input and output devices joined to the M-220M digital computer, which contains external magnetic drum and magnetic tape stores, and also a graph plotter of type DRP-3M.

The software consists of the aggregate of programs which include those servicing the information input and output devices, the graph plotter and some other devices and also those designed for direct investigation of KES characteristics in different operating modes.

Purposes of the investigation. The main purpose which was followed in modelling KES was to determine the possibility of realizing it using an on-board digital computer. It is natural that it becomes necessary in this case to quantify and sample the compared images. It is clear that, to

economize on memory and to increase the speed of this version of KES, one must strive toward maximum compression of the information used for its operation. However, it is obvious on the other hand that this should lead to losses in the operating accuracy and a decrease of the noise stability of the KES.

The foregoing permits one to formulate the main goals of investigation in the following manner: 1) to determine the effect of image quantification by space and brightness on the accuracy and noise characteristics of KES and 2) to determine the effect of oscillations of the object in space on the accuracy and noise characteristics of the KES with regard to digital realization of it. These items encompass the set of problems of investigation.

[241]

UDC 681.518.2

AUTOMATIC SELECTION OF REFERENCE OBJECTS ON AERIAL SPACE IMAGES

A. N. Belinskiy and L. P. Yaroslavskiy

A wide range of problems on study of natural resources using aerial and space images requires for solution combination of photographs of the same terrain obtained at different spectral intervals, at different times and from different points. This combination must be accomplished by reference objects selected on the photographs since the combination of photographs as a whole requires significant computer time and, moreover, is not always possible because of geometric distortions arising because of variation of the conditions photography.

In visual interpretation, the basis of selecting objects which may be used as reference objects is the degree of their identification [1] and it is recommended in this case that one of the contour points of this object be selected as the reference object [2]. Examples of reference objects are bends of rivers, individual peaks of mountains, road crossings, angles of forest tracks and so on. By utilizing visual and visual-instrumental methods of measurements in aerial and space photographs, the reference points selected according to the described recommendations are consolidated by splitting them on the photograph.

When digital computers are used to process images, several methods of localizing reference objects are used. The procedure of finding reference objects for comparison of two space images is accomplished in [3, 4] by means of a half-tone display. The images are shown on the display screen

and the necessary objects are selected visually on it. A method is described in [5] in which the reference objects required for geometric transformation of images are also identified visually. The position of the reference point is determined by means of a special measuring device which issues the coordinates of this point in the form of the number of the line and column. To accelerate the operations of localization, it is suggested that the selected reference points be split on the initial photographic film prior to conversion to digital form and that zero brightness be given to it.

A method of selecting reference points distinct from those previously given is described in [6], devoted to automation of restoration of the terrain relief by a stereo pair. The angular point of the contrast line is selected as the reference point here. The contrast line is found by measuring the illumination gradient at each point of the bounded segment of the image.

The enumerated methods of selection and localization of reference points have obvious disadvantages. Nonautomatic methods are distinguished by cumbersomeness and obviously by low accuracy due to the possible errors of a subjective nature. Moreover, it is desirable in mass processing of images to provide complete automatic processing. The method proposed in [6] cannot be called completely automatic and its accuracy will depend on the threshold whose use is necessary to determine the contrast lines and which is usually found empirically.

A method of automatic selection of reference objects, proposed in [8], is investigated in the given paper.

[243-244]

The program which realizes this algorithm is written in Fortran-IV language for the YeS-1022 computer.

An aerial photograph image measuring 384 X 512 of the component on which agricultural lands are shown was used in the experiment. The intial spacing of the image division was taken as equal to the dimension of the fragment (32 X 32 components) and a search for the regions of finding the reference objects was conducted. As a result, an image was formed which illustrates the fragmented energy distribution of the dilute spectrum in this case the fragment with increased energy of the washed-out spectrum, and in this case corresponds to the fragment with increased density. The pattern obtained reflects the rough determination of contours. Further, by searching within the allocated regions with lesser spacing, we finally localize the reference objects within which we select the reference points.

It is interesting to note in conclusion that automatically localized reference objects were included in the number of objects visually selected by the interpreter.

[302-305]

UDC 62-50

Recurrent-Search Algorithms of Estimation in Correlation-Extreme Navigation Systems, Beloglazov, I. N.

Recurrent-search algorithms of estimation, which are a combination of the idea of Kalman filtration and the theory of checking statistical hypotheses which are the theoretical bases of search methods of estimation in correlation-extreme navigation systems, are considered. References 7, figures 3.

UDC 621.516.42,511.43.001.24

Investigating the Dynamics of Two-Dimensional Correlation-Extreme Systems, Vasil'yev, D. V., G. G. Ivanov, S. A. Kil'veyn and E. P. Chernyshev.

Analytical analysis of the dynamics of two-dimensional correlation systems with symmetrical cross-couplings and relay control by the harmonic balance method is presented. References 4, figures 2.

UDC 62-506.1

Adaptive Principles of Constructing Correlation-Extreme Systems, Ol'shevskiy, V. V.

General theories of constructing adaptive correlation-extreme systems, as the basis of which the general principles of adaptation and their different modifications are used, are discussed. References 10, figures 1.

UDC 62-50

Problems of Modelling Correlation-Extreme Navigation Systems, Chigin, G. P.

Problems of modelling correlation-extreme navigation systems (KENS) are considered. Emphasis is placed on discussion of problems of constructing working charts of KENS. The algorithmic software of KENS is classified and briefly analyzed. References 6, figures 13.

UDC 62-506

Probability Investigation of Non-Reference KES, Kislitsyn, S. A. and A. M. Korikov.

Probability description of images used in correlation extreme systems is presented. An algorithm for global minimization of the correlation function is proposed for the case of Markov images. References 4.

UDC 62-50

Algorithms of Optimization for Multidimensionsal Correlation-Extreme Systems, Alekseyev, V. I.

Stochastic algorithms are presented for investigation of the structure of entire functions and for finding the local and global extremum of good and poorly determined functions. References 9, tables 2.

UDC 621.391.268:519.237.5

Determination of the Accuracy and Probability Characteristics of KES by the Statistical Parameters of the Correlation Field, Myasoyedov, G. B. and V. I. Popova.

Examples of determining the accuracy and probability parameters of correlation-extreme systems under conditions of limitation of the averaging field when calculating the values of the statistical characteristics of the correlation field are considered. References 2.

UDC 519.233.22

Selection of the Parameters of Discrete Display of Images in KES, Buymov, A. G.

A model of the dependence of the dispersion of extreme combination of terrain maps in KES on the dimensions of discrete display of maps is constructed. The parameters of this display with certain constraints are optimized. References 5, figures 4.

UDC 62-506.1

Selection of Optimum Parameters of an Optical Correlator, Beloglazov, N. N.

Problems of selecting the parameters of an optical noncoherent lens correlator with regard to the conditions of its use, methodical errors and available constraints are considered. References 3, figures 6.

UDC 62-50

The Extreme-Module Method, Gur'yev, I. S.

The extreme-module method of estimation, constructed on the basis of minimizing the absolute sums of the measurement error vectors, is considered. The stability and simplicity of the algorithm of the considered method is shown on the example of normalized realization of measurements. References 8, tables 1.

[306]

UDC 53.072:681.3

Simulation of Three-Dimensional Fields with Given Statistical Characteristics for Investigation of KES, Buymov, A. G. and M. T. Reshetnikov

A brief survey of the known methods of simulating random fields is given and their applicability for investigation of the accuracy and noise stability of correlation-extreme systems is analyzed. References 28.

UDC 62-506.222.001.57

A Variable-Goal Teaching Algorithm, Karpov, Ye. G.

A recurrent teaching algorithm of an identification system which permits variation of the goal of teaching when obtaining current information, which in turn permits minimum identification errors even in the case of unsuccessful selection of penalty functions is proposed. References 2, figures 4, tables 1.

[307-312]

UDC 621.391.268:517.3

Investigating Zero Fluctuations of the Direction-Finding Characteristic of a KES with Orthogonal Reference, Kil'veyn, S. A. and G. S. Filippov.

Zero fluctuations of the direction-finding characteristic of a correlation-extreme system (KES), caused by limitation of the averaging interval, is investigated from the viewpoint of estimation theory. A signal orthogonal to that observed is used as the reference signal in the KES. References 4, figures 1.

UDC 681.518.3

Some Problems of Compression of Information on a Two-Dimensions Image With Respect to a Navigation Problem, Pashnev, S. Ya.

An algorithm of compression of information on a two-dimensional image based on determination of the informative features of these images sufficient for identification of them and estimation of mutual displacements, is proposed. References 1, figures 2.

UDC 621.327.9:681.325

Automation of KES Investigations Based on Small and Large Computers, Yurga, N. I.

The software-hardware complex which includes the M-220-M, M-6000 and YeS-1020 digital computers, created to solve problems of analysis and synthesis of KES which utilize images as working information, is described. References 8, figures 4.

UDC 53.088:629.78.05:527

Some Methods of Increasing the Accuracy of Radar Coordinators, Karpov, A. G. and O. M. Ravodin

Methods of compensating for the errors of mockups of correlation-extreme systems which utilize radar images of terrain as navigation information, are proposed. References 13, figures 2.

UDC 527.621

Investigating the Entire Function of the SERN-P Difference-Rangefinder, Korikov, A. M. and Ye. N. Saf'yanova.

The entire function of a two-dimensional difference-rangefinding extreme navigation system in which the navigation parameters are recalculated to the coordinates of radio stations, is investigated. References 5, figures 12.

UDC 519.2

Nonlinear Partial and Multiple Correlation Functions, Golosov, Yu. I.

The concept of nonlinear covariational and correlation functions and also of nonlinear partial and multiple correlation functions is considered. The accuracy of their estimation is presented. References 3.

UDC 519.237.5-534.242:681.3

Correlation Characteristics of Ocean Reverberation (Machine Modelling), Ol'shevskiy, V. V., V. A. Panfilov and A. V. Pinchuk.

Sonar correlation-extreme systems are defined and materials are presented on modelling of ocean reverberation as a random process. The results of correlation analysis of ocean reverberation in the frequency-time zone are presented. References 11, figures 5.

UDC 621.391.2

An Auto-Correlation Detector of a Periodic Pulsed Signal in Normal Noise, Yegorov, I. M. and A. A. Shelestov.

The problem of detecting pulsed signals and of estimating their time position based on the autocorrelation function is investigated. A numerical example is given. References 6, figures 1.

UDC 62-506.1

Investigating Models of Single-Circuit Correlation Tracking Systems of the Delay, Ponomarenko, V. P.

The results of investigating the conditions and nonlinear processes of control in correlation delay-tracking systems are presented. References 7, figures 4.

UDC 62-506

Correlation-Extreme Robot-Engineering Systems, Korikov, A. M.

Problems of modelling the external medium in robots of different generations are discussed in the presence of models of the medium in correlation-extreme systems (KES) is noted. The capabilities of using KES to activate programmed manipulation robots and for navigation of transport robots are used. References 15.

UDC 681.142:62-5

The Error Probability of a Transport Robot Identifying the Direction of Motion Using KES-1, Reznik, V. G.

Application of KES-1 to the problem of identifying the trajectory of motion of a transport robot is considered and the error probability of this identification system is calculated by using the Bayes approach. References 5.

UDC 681.518.3

A Television Correlation-Extreme Sensory Device for Industrial Robots, Angelov, M. P. and V. I. Syryamkin.

A modckup of a correlation-extreme sensory device for estimating the angular and linear coordinates of parts on a plane is described. The results of testing the mockup are presented. References 6, figures 5.

UDC 338.612.008.01:621.391.173

A Correlation-Extreme System for Finding and Sorting Articles During Assembly, Afrimzon, A. F.

A correlation-extreme system (KES) designed to identify a rather wide variety of parts making up a set arriving at the assembly conveyor of a machine building enterprise, assigning type-determining cipher to each of them and entering this cipher in the computer, which is the basis of construction of ASU TP [automated system for the control of technological processes], is described. The KES is based on calculation of the cross-correlation function of Fourier images of the part and the reference image. References 4; figures 1.

UDC 621.771.23:62-506.1

Using KES in a Continuous Rolling ASU TP, Blyumin, S. L. and L. A. Kuznetsov.

Problems of using correlation-extreme systems for measuring the speed of a strip to monitor thicknesses and transport delays in interstand intervals required for the algorithm of optimum control of thickness based on the model of a continuous special type of rolling mill are considered. References 3.

UDC 681.783.323:535.8

Determining the Angle of Twist by the Correlation-Extreme Method, Karpov, A. G. and O. M. Ravodin.

A correlation-extreme system (KES) for determining the angle of twist is proposed. The potential accuracy is estimated. The distinguishing feature of the considered KES is the use of images converted to "range-angle" in rectangular coordinates. References 5, figures 4.

UDC 527.625.2:681.3

Image Analysis in Correlation-Extreme Monitoring Systems Based on Walsh Conversion, Berezin, V. Yu., Yu. M. Polishchuk and N. I. Yurga.

Some aspects of using the Walsh base for image processing when solving global monitoring problems are considered. References 5, figures 3.

UDC 615.471:612.172.4

Using the Spectral Characteristics of Electrocardiograms for Automatic Diagnosis of Heart Diseases, Pobozhiy, S. B. and V. A. Shlotgauer.

The results of investigating the spectral composition of EKG are presented and an algorithm for spectral diagnosis is proposed. References 7, figures 1.

[313-317]

UDC 681.5:517.977

Using the Extreme Approach to Synthesize Adaptive Algorithms for Identification and Control of Dynamic Objects, Ruban, A. I. and A. A. Svetlakov.

A diagram for synthesis of adaptive algorithms for solving extreme problems of identification and control of production objects is proposed. Adaptive algorithms for identification and control of intrabath galvanic processes are presented as an example. References 4.

UDC 62-50

Using Covariation Functions and Spectral Planes in Numerical Methods of Identification, Kaminskas, V. A.

Problems of using correlation functions and spectral planes in numerical algorithms of identification of linear dynamic systems with a bilinear transfer function are considered. References 3.

UDC 629.7.051

Synthesis of Optimum Control in Stochastic Distributed Systems with Local Criterion of Quality, Degtyarev, G. L.

The problem of control synthesis from the condition of the minimum mean value of integral quadratic form is considered. References 3.

UDC 62.501

Method of Combining Identification and Optimization of Complex Objects, Lerner, V. S.

A new method of joint solution of problems of identification and optimum control of complex stochastically distributed and concentrated objects is proposed. Identification is accomplished by using the information measure of the relative proximity of random fields.

UDC 62-501.72

An Extreme Algorithm of Identification by the Method of Inverse Problems with Adaptation, Bashkina, G. A., Ye. G. Kleyman, V. S. Kozlyakov and I. A. Mochalov.

An algorithm for estimating the parameters of production processes described by equations in partial derivatives is proposed. The algorithm is explained on the example of estimating the coefficient of thermal conductivity in the equation which describes the process of heating a plate. References 2.

UDC 519.2

Control of Diffuse Processes By Means of the Coordinate Conversion Method, Semenchin, Ye. A. and I. D. Cherkasov.

It is shown that the problem of controlling a diffusion process can be reduced to a problem of investigation to the extreme value of some functional. References 2.

UDC 62-501.7

Solution of the Problem of Discrete Control of An Inertialess Object During Disturbance by a Random Steady Process, Maksimov, A. V. and N. M. Oskorbin.

A simple algorithm for discrete control of an object affected by disturbances is proposed. A system of equations is found for determining the coefficients in the structure of the control operator. References 1.

UDC 519.6

Analysis of the Accuracy of a Static Object Control System, Sukhanov, V. A.

The accuracy of functioning of a single static-object control system is analyzed. References 3.

UDC 62-501.14

The Factorial Interpolation Method of Determining the Probability Characteristics of Dynamic Systems, Svilin, A. V.

Cubic formulas are constructed for calculating the probability characteristics of the output coordinates of nonlinear dynamic systems with random disturbances. The proposed method permits one to calculate the statistical characteristics of SAU [Automatic control system] (the moments of the SAU output coordinates) with smaller number of realizations (tests) than is required in the Monte-Carlo method and the equivalent disturbance method. References 5.

UDC 62-50

Extreme Control of a Resonance Object, Obabkov, V. K., Ye. V. Sergin and Yu. N. Tseluyevskiy.

Correlation processing of combination frequencies of a test signal is used to construct extreme resonance object control systems. References 6, figures 1.

UDC 658.5.011.56:66.013

Using the Principles of Extreme Control in ASU TP of Some Petrochemical Plants, Kopman, V. A. and Osipov, V. G.

Problems of controlling a stochastic petrochemical process with fine tuning of the model parameters are solved on the basis of using extreme methods. The developed algorithms are intended for direct digital control of processes in real time and are realized on one of the control systems of a commercial carbon plant using a series UVM (process control computer). References 5.

UDC 62-506.1

Using the Nonlinear Filtration Method to Synthesize Correlation-Extreme Navigation Systems, Baklitskiy, V. K.

A method of synthesizing space-time nonlinear filtration of a physical field is presented. The results were found for an interfering background of the narrow band gaussian process type. References 7, figures 1.

UDC 621.391.828:77.528.7

Stabilization of the Steepness of the Discriminator Characteristic of a Correlation-Extreme Image Shift Meter, Danilov, B. V., Sharov, Yu. V. and Shtykhno, V. V.

Methods of stabilizing the steepness of the discriminator characteristic of an optical correlation-extreme meter of differential types when operating by images with different characteristics are considered. References 8, figures 4.

6521
CSO: 1863

UDC 681.3:061.3

PROBLEMS OF THE DEVELOPMENT AND UTILIZATION OF HIGH-CAPACITY INFORMATION AND COMPUTING MACHINES

Moscow PROBLEMY SOZDANIYA I ISPOL'ZOVANIYA VYSOKOPROIZVODITEL'NYKH INFORMATSIONNO-VYCHISLITEL'NYKH MASHIN in Russian, All-Union Scientific and Technical Conference, Kishinev, 9-11 Oct 79, SISTEMNOYE PROGRAMMIROVANIYE, CHISLENNYYE METODY [Systems Programming, Numerical Methods], Abstracts of Papers, 1979 135 pp

[From REFERATIVNYY ZHURNAL. INFORMATIKA No 2, 1980 Abstract No 2 I239 K by V. L.]

[Text] Abstracts of papers are presented, among them the following: "A Method for Organizing Memory Hierarchy in a Multiprocessor Computational System With a Single Flow of Commands," "On the Possibility of Designing Problem-Oriented Multiprocessor Computational Packages Based on the YeS-1035 Computer," "An Approach to the Selection of the Design of the Display System," "An Effective Method for Data Storage and Retrieval."

"On the Possibility of Designing Multimachine Computational Systems Based on YeS Computers," "Properties of the Speech Signal and Their Application in Speech Recognition and Synthesis Systems," "Voice Input of Information Into Computers," "Methods for Developing Search Procedure Algorithms for Multiprocessor Systems."
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