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USSR Report

CYBERNETICS, COMPUTERS AND AUTOMATION TECHNOLOGY

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USSR REPORT

CYBERNETICS, COMPUTERS AND AUTOMATION TECHNOLOGY

(FOUO 6/80)

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Hardware

USSR UDC 681.322.01

A PARALLEL COMPUTER SYSTEM FOR MK-PROGRAMS

Khar'kov PROBLEMY BIONIKI [Problems of Bionics] in Russian No 23, 1979 pp 85-92

KOLUBAY, S. K.

[From REFERATIVNYY ZHURNAL, AVTOMATIKA, TELEMEKHANIKA I VYCHISLITEL'NAYA TEKHNIKA, VYCHISLITEL'NAYA TEKHNIKA No 12, 1979 Abstract 12B11]

[Text] The structure of a parallel computer system for processing MK-programs, in which the principle of memory separation into passive and active is realized, is proposed. Data and results are stored in the classical type passive memory. The programs (MK-programs) to be processed are stored in the active memory, constructed in a special manner. The active memory is called the processor-memory. The possibilities of realizing a processor-memory cell and of the entire block as a whole are discussed. Figures 4; tables 4; references 2. [195-6521]

USSR UDC 681.335.8(088.8) (47)

OPTICO-ELECTRONIC FUNCTIONAL TRANSDUCER

USSR Patent No 642732, claimed 17 Mar 76, No 2348003, published 15 Jan 79

BAKHMUTSKIY, V. F., KONOVALOV, S. M., SHEPTEBAN', R. Z., YAKUSHEV, V. S., Special Design Office of Microelectronics in Instrument Building

[From REFERATIVNYY ZHURNAL, AVTOMATIKA, TELEMEKHANIKA I VYCHISLITEL'NAYA TEKHNIKA, VYCHISLITEL'NAYA TEKHNIKA No 12, 1979 Abstract 12B533P]

[Text] An optico-electronic functional transducer containing a series-connected light amplifier, electrooptical transducer, optical signal processing block and photoelectronic transducer whose output is connected to the input of the next analog-code transducer is proposed. [195-6521]

USSR UDC 681.327.67(088.8)(47)

CURRENT PULSE SHAPER FOR ADDRESS SELECTION DEVICE

USSR Patent No 652611, claimed 14 Sep 77, No 2526178, published 19 Mar 79

BORISOVA, A. L., GOLOVKOV, V. M., RYBIN, I. M. and FEDOROV, A. S., Institute of Electronic Control Machines

[From REFERATIVNYY ZHURNAL, AVTOMATIKA, TELEMEKHANIKA I VYCHISLITEL'NAYA TEKHNIKA, VYCHISLITEL'NAYA TEKHNIKA No 12, 1979 Abstract 12B326P]

[Text] The shaper contains a transistor and a pulse transformer with three windings, the first of which is connected to the input line. The transistor collector is connected to the first output line. To increase reliability, the device contains a second output line which is connected to the beginning of the third and the end of the second winding of the pulse transformer whose beginning is connected to the transistor base and the end of the third winding is connected to the transistor emitter. Figures 1. [195-6521]

USSR UDC 681.325.59(088.8)(47)

A TEACHING MATRIX STRUCTURE

USSR Patent No 662970, claimed 26 Nov 76, No 2423557, published 18 May 79

DOMIN, V. A., MAZO, B. L. and RAYEV, V. K., Institute of Electronic Control Machines

[From REFERATIVNYY ZHURNAL, AVTOMATIKA, TELEMEKHANIKA I VYCHISLITEL'NAYA TEKHNIKA, VYCHISLITEL'NAYA TEKHNIKA No 12, 1979 Abstract 12B246P]

[Text] The device contains thin magnetic films with easy magnetization axes along their length, excitation lines located along the thin magnetic films and conducting coils located near the ends of the thin magnetic films perpendicular to the easy magnetization axes. Forbid lines located perpendicular to the easy magnetization axes of the thin magnetic films were introduced into the device in order to improve the reliability and to reduce the error of the adaptive structure. Figures 5. [195-6521]

USSR UDC 681.325.5(088.8)(47)

ARITHMETIC-LOGIC DEVICE

USSR Patent No 648979, claimed 2 Jun 76, No 2367316, published 25 Feb 79

SOLKHIN, A. A. and FILIN, A. V., Institute of Electronic Control Machines

[From REFERATIVNYY ZHURNAL, AVTOMATIKA, TELEMEKHANIKA I VYCHISLITEL'NAYA TEKHNIKA, VYCHISLITEL'NAYA TEKHNIKA No 12, 1979 Abstract No 12B239P]

[Text] The device contains registers of the first and second operands, a carry propagation block, two-input adder and a first logic switch whose digit inputs are connected to the outputs of the direct and inverse values of the register digits of the first and second operands. Second, third and fourth logic switches, an AND element block and result register were introduced to the device in order to increase its speed when performing multiplication and division operations. Each digit of the first logic switch contains seven AND elements and two OR-NOT elements. Each digit of the second logic switch contains an AND element and an OR-NOT element whose output is connected to the output of the logic switch and whose inputs are connected to the second input of the logic switch and the output of the AND element, whose inputs are connected to the first and third inputs of the second logic switch. Figures 2. [195-6521]

USSR UDC 681.326.3

DEVICE FOR CONTROL OF DATA INPUT-OUTPUT OPERATIONS

USSR Patent No 641435, claimed 12 Aug 76, No 2396944, published 7 Jan 79

BOYARCHENKOV, M. A., BEREZENKO, A. I., KONTAREV, V. YA., KORYAGIN, L. N., KRYLOV, G. A., LENGNIK, L. M., SHATS, S. A. and FEL'DMAN, B. YA., Institute of Electronic Control Machines

[From REFERATIVNYY ZHURNAL, AVTOMATIKA, TELEMEKHANIKA I VYCHISLITEL'NAYA TEKHNIKA, VYCHISLITEL'NAYA TEKHNIKA No 12, 1979 Abstract 12B204P]

[Text] A device for controlling data input-output operations, containing a processor, storage block and coupling block joined by two-way information contacts, is proposed and the control output of the processor is connected to the control inputs of the memory and coupling blocks whose inputs and outputs are connected to the inputs and outputs of the device, respectively. A time signal shaping block whose first control input is connected to the

processor control output, a consequent control input of the time signal shaping block and the control input of the processor are connected to the control input of the device and the output of the time signal shaping block is connected to the timing input of the processor, is introduced in order to increase the speed and to provide universal application for a wide range of external devices and computers. A device is proposed in which the time signal shaping block contains a register, comparison circuit, calculating subassembly and pulse generator whose output is connected to the counting input of the counting subassembly whose outputs and the outputs of the register are connected to the inputs of the compressive circuit, respectively. The register input and the first input of the counting subassembly are connected to the first control input of the block, the second input of the counting subassembly is connected to the second control input of the block and the third input is joined to the output of the block and is connected to the output of the comparison circuit. Figures 4; references 2. [195-6521]

USSR UDC 681.327.4'21:621.391.63(088.8)(47)

DEVICE FOR CORRECTING THE POSITION OF THE PHOTOREADING ELEMENT OF AN AUTOMATIC READING DEVICE

USSR Patent No 647615, claimed 29 May 75, No 2139493, published 18 Feb 79

VOZIYANOV, A. F., GIMMEL'FARB, G. L., KOVALEVSKIY, V. A., PETRUSENKO, V. K. and SEMENOVSKIY, A. G., Institute of Cybernetics of the Ukrainian SSR Academy of Sciences

[From REFERATIVNYY ZHURNAL, AVTOMATIKA, TELEMEKHANIKA I VYCHISLITEL'NAYA TEKHNIKA, VYCHISLITEL'NAYA TEKHNIKA No 12, 1979 Abstract 12B381P]

[Text] A device is proposed for correcting the position of the photoreading element of an automatic reading device, which contains a drive connected to the photoreading element whose output is connected to the identification block, and an amplification block connected to the drive. The device contains a functional transducer connected to the identification block, a signal shaping block of the operating system connected to the drive and a comparison block whose inputs are connected to the functional transducer and the signal shaping block of the operating system, while the output is connected to the amplification block. The functional transducer contains a series-connected decoder, AND elements and a logic subassembly. Figures 1; references 2. [195-6521]

USSR UDC 681.327.12 (088.8)

PLOTTING BOARD FOR READING GRAPHICAL INFORMATION

USSR Patent No 647705, claimed 22 Apr 77, No 2478961, published 18 Feb 79

KOSHCHEY, A. M., Special Design and Technological Office [SKTB] of Computer Equipment

[From REFERATIVNYY ZHURNAL, AVTOMATIKA, TELEMEKHANIKA I VYCHISLITEL'NAYA TEKHNIKA, VYCHISLITEL'NAYA TEKHNIKA No 12, 1979 Abstract 12B503P]

[Text] A plotting board is known which contains a resistive plate with coordinate lines connected to a power supply source and a transparent clamping plate. The purpose of the invention is to increase the speed of the plotting board. A conducting plate located between the clamping and resistive plates and a movable magnetically sensitive contact located in the gap between the resistive and conducting plates have been introduced to it for this purpose. Figures 1; references 2. [195-6521]

USSR UDC 681.335.5(088.8)(47)

MULTIPLICATION DEVICE

USSR Patent No 651359, claimed 6 Jul 77, No 2504460, published 5 Mar 79

BABAYAN, R. R. and MOROZOV, V. P., Institute of Control Problems

[From REFERATIVNYY ZHURNAL, AVTOMATIKA, TELEMEKHANIKA I VYCHISLITEL'NAYA TEKHNIKA, VYCHISLITEL'NAYA TEKHNIKA No 12, 1979 Abstract 12B516P]

[Text] The device contains a multiplier element with controlled transconductance and paraphase outputs, the first of which is connected to the inverting input of the operational amplifier and through a first scale resistor to the output of the device. An additional operational amplifier whose inverting input is connected to the second output of the multiplier element and whose output is connected through second and third scale resistors to the first and second outputs of the multipler element was introduced into the device in order to increase the accuracy of multiplication. Figures 1. [195-6521]

USSR UDC 681.326.7(088.8)(47)

COMPUTER DIAGNOSTIC DEVICE

USSR Patent No 641453, claimed 3 Dec 76, No 2436513, published 7 Jan 79

MKRTUMYAN, I. B., KARAKHANYAN, M. O., AKOPYAN, E. V. and DZHILIAVYAN, S. T.

[From REFERATIVNYY ZHURNAL, AVTOMATIKA, TELEMEKHANIKA I VYCHISLITEL'NAYA TEKHNIKA, VYCHISLITEL'NAYA TEKHNIKA No 12, 1979 Abstract 12B210P]

[Text] The device contains a memory block, adjustable data register, operations decoder, switch, register of state, register of zone and two comparison circuits. A preventive checking register, counter, address selection block and voltage level switching block whose input is connected to the output of the preventive checking register are introduced into the device to increase the repairability of a computer. Figures 1. [195-6521]

USSR UDC 681.325.57(088.8)(47)

DEVICE FOR MULTIPLICATION AND DIVISION OF NORMALIZED NUMBERS

USSR Patent No 648980, claimed 19 Apr 76, No 2349039, published 25 Feb 79

BAKLAN, B. A., State All-Union Design and Technological Office on Design of Calculating Machines, Experimental Plant

[From REFERATIVNYY ZHURNAL, AVTOMATIKA, TELEMEKHANIKA I VYCHISLITEL'NAYA TEKHNIKA, VYCHISLITEL'NAYA TEKHNIKA No 12, 1979 Abstract 12B231P]

[Text] The device contains a partial product adder, a first register, a second register, inverse value calculation block, control block, partial product formation block and accumulator register. An AND and a multiplier switch whose first input is connected to the output of the control block were introduced to the device in order to simplify it and to increase the speed during division. Figures 1. [195-6521]

USSR UDC 681.322.013

AUTOMATIC CONSTRUCTION OF PARALLEL PROGRAMS, PARALLELING OF EXPRESSIONS AND CYCLES

Unknown VYCHISLITEL'NIY TSENTR SIBIRSKOGO OTDELENIYA AN SSSR [The Computer Center of the Siberian Department of the USSR Academy of Sciences, Preprint] in Russian No 146, 1979

VAL'KOVSKIY, V. A. and KOTOV, V. YE.

[From REFERATIVNYY ZHURNAL, AVTOMATIKA, TELEMEKHANIKA I VYCHISLITEL'NAYA TEKHNIKA, VYCHISLITEL'NAYA TEKHNIKA No 12, 1979 Abstract 12B30]

[Text] Methods of automatic construction of parallel algorithms and programs are surveyed. Some sufficiently complete and systematic classification of paralleling methods are given in the introduction. The survey of papers on restructurization of expressions for subsequent parallel performance is offered in section 1 and the second section is devoted to paralleling of cyclic structures. [195-6521]

USSR UDC 681.322.068

POSTULATION OF THE CYCLE REALIZATION PROBLEM IN A CLASS OF COMPUTERS

Unknown INSTITUT PRIKLADNOY MATEMATIKI AN SSSR [Institute of Applied Mathematics of the USSR Academy of Sciences, Preprint] No 101, 1979

GORELIK, A. M., LYUBIMSKIY, E. Z., MITASHYUNAS, A. YU. and TARASOV, V. V.

[From REFERATIVNYY ZHURNAL, AVTOMATIKA, TELEMEKHANIKA I VYCHISLITEL'NAYA TEKHNIKA, VYCHISLITEL'NAYA TEKHNIKA No 12, 1979 Abstract 12B70]

[Text] Formal postulation of the problem of cycle realization in a class of computers is proposed. The principles of formalizing the indexing capabilities of computers are described. A theorem which demonstrates the efficiency of the proposed apparatus is proved. [195-6521]

USSR UDC 025.43(038)

AUTOMATIC CONSTRUCTION OF A FREQUENCY DICTIONARY OF STEMS BASED ON ASIOR FILES

Moscow INFORMATIKA in Russian Institute of Applied Mathematics of the USSR Academy of Sciences 1979

AVRAMENKO, V. S.

[From REFERATIVNYY ZHURNAL, INFORMATIKA No 11, 1979 Abstract 11I197K]

[Text] A method of constructing a frequency dictionary of stems ("zero thesaurus") based on files introduced into the ASIOR information retrieval system and numbering approximately 260,000 documents is described. A method of administering the dictionary of stems is outlined. The program for creation of the dictionary of stems is written in BEMSh autocode (BESM-6). The dictionary provides specific search functions and the input vocabulary checking function in the ASIOR-M information retrieval system. Figures 5; references 5. [195-6521]

USSR UDC 681.3.06

DESIGNING A FOREX TRANSLATOR FOR THE AS-6 CENTRAL PROCESSOR

Unknown INSTITUT PRIKLADNOY MATEMATIKI AN SSSR [Institute of Applied Mathematics of the USSR Academy of Sciences, Preprint] in Russian No 59, 1979

GALATENKO, V. A. and KHODULEV, A. B.

[From REFERATIVNYY ZHURNAL, AVTOMATIKA, TELEMEKHANIKA I VYCHISLITEL'NAYA TEKHNIKA, VYCHISLITEL'NAYA TEKHNIKA No 12, 1979 Abstract 12B68]

[Text] Design of the FOREX Fortran compiler for the AN-6 central processor is described. Brief characteristics of the AS-6 central processor are given. Agreements on the relationships between subprograms are described. Comparative data on the operation of the translator for the BESM-6 and the central processor are presented. [195-6521]

USSR UDC 681.322.015

MODERN DIALOGUE EDITORS

Moscow INSTITUT PRIKLADNOY MATEMATIKI AN SSSR [Institute of Applied Mathematics of the USSR Academy of Sciences] in Russian 1979

LYUBIMSKIY, E. Z. and MALINKIN, A. V.

[From REFERATIVNYY ZHURNAL, AVTOMATIKA, TELEMEKHANIKA I VYCHISLITEL'NAYA TEKHNIKA, VYCHISLITEL'NAYA TEKHNIKA No 12, 1979 Abstract 12B77K]

[Text] A systematic survey of the facilities available to the user of modern dialogue editors of program texts is given. [195-6521]

USSR UDC 681.327.067

THE DISPATCHER IN THE FAUST SYSTEM, PART 1, THE STRUCTURE OF THE DISPATCHER, MEMORY AND PROCESSOR CONTROL

Serpukhov INSTITUT FIZIKI VYSOKIKH ENERGIY [Institute of High-Energy Physics, Preprint] in Russian No 79, 1979

BOYTSOV, V. N., VONCH-OSMOLOVSKIY, A. L., IVANOV, YU. N., SYCHEV, A. YU. and SHCHERBAKOV, YE. D.

[From REFERATIVNYY ZHURNAL, AVTOMATIKA, TELEMEKHANIKA I VYCHISLITEL'NAYA TEKHNIKA, VYCHISLITEL'NAYA TEKHNIKA No 12, 1979 Abstract 12B7]

[Text] A dispatcher which performs the function of a standard real-time operating system in the FAUST system is considered. The structure, composition and characteristics of the dispatcher related to the specifics of multiaccess organization in the system of projectors connected to ICL-1903A type computers are described. References 13. [195-6521]

USSR UDC 681.322.06.6

THE DIALOGUE SYSTEM OF WORKING WITH SYMBOLIC LIBRARIES IN THE OPERATING SYSTEM OF THE UNIFIED COMPUTER SYSTEM

Serpukhov INSTITUT FIZIKI VYSOKYKH ENERGIY [Institute of High-Energy Physics] in Russian No OMBT-56, 1979

VOSKRESENSKIY, N. A., KUL'MAN, N. YU. and KUL'MAN, T. N.

[From REFERATIVNYY ZHURNAL, AVTOMATIKA, TELEMEKHANIKA I VYCHISLITEL'NAYA TEKHNIKA, VYCHISLITEL'NAYA TEKHNIKA No 12, 1979 Abstract 12B63]

[Text] The REBUS system, designed to work with symbolic libraries of the unified operating system in the dialogue mode is described. There are different possibilities of working with sections and also a convenient text editor. References 3. [195-6521]

USSR UDC 681.322.068

EXPANDING THE CAPABILITIES OF FORTRAN-IV LANGUAGE OF THE YeS-1010

DUBNA OB'YENINENYY INSTITUT YADERNYKH ISSLEDOVANIYE [Joint Institute for Nuclear Research, Communication] in Russian No 10-12358, 1959

SERGEYEV, S. V.

[From REFERATIVNYY ZHURNAL, AVTOMATIKA, TELEMEKHANIKA I VYCHISLITEL'NAYA TEKHNIKA, VYCHISLITEL'NAYA TEKHNIKA No 12, 1979 Abstract 12B93]

[Text] Subprograms which permit the program carried out in FORTRAN-IV language to utilize more completely the capabilities offered to the user of the YeS-1010 operating system have been developed. The subprograms LA, MEM and MOVE permit the call program access to the monitor tables, to dynamically create and utilize data files located in an arbitrary place of the memory, to work with the user address of the memory and to accomplish interaction of programs connected to different interrupt levels of the YeS-1010 system. The DCIO subprogram exchanges data with any zone of the system magnetic disc. The ARIN subprogram permits introduction of numbers in a format with floating decimal, changing the FORTRAN-IV format input system. The given subprograms facilitate the use of high-level FORTRAN-IV language in writing programs for reception and preliminary processing of physical information for the YeS-1010. [195-6521]

USSR UDC 681.322.068

INTRODUCING COMPILER FOR CDL FOR COMPILERS ON THE BESM-6 COMPUTER

Dubna OB'YEDINENYY INSTITUT YADERNYKH ISSLEDOVANIYE [Joint Institute of Nuclear Research, Preprint] in Russian No P11-12340, 1979

MAKARENKOVA, A. D., NAZAROV, YU. A. and KHOSHENKO, A. A.

[From REFERATIVNYY ZHURNAL, AVTOMATIKA, TELEMEKHANIKA I VYCHISLITEL'NAYA TEKHNIKA, VYCHISLITEL'NAYA TEKHNIKA No 12, 1979 Abstract 12B72]

[Text] The most typical properties of the declaration language of CDL [Computer description language] translators are considered. A two-pass circuit for converting the CDL transmitter from a CDC-6500 computer to a BESM-6 computer and its main operating characteristics during operation of the translator in the Dubna operating system are presented. [195-6521]

USSR UDC 681.322.068

REALIZING THE ANALYTICAL CONVERSION LANGUAGE ON A BESM-6 TYPE COMPUTER

Dimitrovgrad NII ATOMNYKH REAKTOROV [Scientific Research Institute of Atomic Reactors, Preprint] in Russian No 17 (376), 1979

MARKOV, YU. V.

[From REFERATIVNYY ZHURNAL, AVTOMATIKA, TELEMEKHANIKA I VYCHISLITEL'NAYA TEKHNIKA, VYCHISLITEL'NAYA TEKHNIKA No 12, 1979 Abstract 12B92]

[Text] Realization of analytical conversion language on a BESM-6 type computer is described. The values of the variable language may be matrices as the elements of which not only numbers but also analytical expressions are permitted. The assignment and transformation operators are determined for those variables in the language. Main attention in realization is devoted to the efficiency of processing large analytical expressions. [195-6521]

USSR UDC 681.326.3

CONTROL OF DATA FLOWS IN COMPUTER NETWORKS

Moscow IZMERENIYA, KONTROL', AVTOMATIZATSIYA [Measurement, Control and Automation] in Russian No 4/20, 1979 pp 34-41, 55

BOGUSLAVSKIY, L. B., KOGAN, YA. A. and MARTIROSYAN, V. A.

[From REFERATIVNYY ZHURNAL, AVTOMATIKA, TELEMEKHANIKA I VYCHISLITEL'NAYA TEKHNIKA, VYCHISLITEL'NAYA TEKHNIKA No 12, 1979 Abstract 12B39 by V. T. Mitroshina]

[Text] Problems of flow control of computer networks in the postal service are considered. The goals and tasks of the flow control are determined. Classification of the flow control mechanisms and their general characteristics are given. The mechanisms for prevention of bottlenecks are described. Such basic mechanisms of flow control as that of information processors in ARPANET at the level of transport stations, mechanisms of adaptive flow control and isorhythmic control, the mechanism of using resources of network data flow processes, the "window" mechanism and two-level control of channels in a virtually commutated channel and mechanisms of limiting the load in channels are described. The variety of flow control mechanisms is determined by differences in the designation and purposes of the postal service, the configuration of protocols, software and hardware and methods of switching different computer networks. Figures 7; references 30. [195-6521]

USSR UDC 681.3:519.68

BLOCK-SCHEMATIC MICROPROGRAMMING LANGUAGE AND SOME PROBLEMS OF REALIZING IT

Riga TSIFROVIYA USTROYSTVA I MIKROPROTSESSORY [Digital Devices and Microprocessors] in Russian No 3, 1979 pp 102-126

MARIN, A. V. and SKORUBSKIY, V. I.

[From REFERATIVNYY ZHURNAL, AVTOMATIKA, TELEMEKHANIKA I VYCHISLITEL'NAYA TEKHNIKA, VYCHISLITEL'NAYA TEKHNIKA No 12, 1979 Abstract 12B47]

[Text] The general characteristics of adjustable high-level microprogramming languages (YaMP) are considered and an informal description of the block-schematic microprogramming language belonging to a given class of microprogramming languages is presented. The main problems which occur in construction of a translator from block-schematic microprogramming language are determined. Figures 2; tables 1; references 9. [195-6521]

USSR UDC 62-501.72

POSTULATION AND INVESTIGATION OF SOME OPERATIONAL CONTROL PROBLEMS IN PROGRAMMING COMPLEXES

Moscow POSTANOVKA I ISSLEDOVANIYE NEKOTORYKH ZADACH OPERATIVNOGO UPRAVLENIYA V PROGRAMMNYKH KOMPLEKSAKH in Russian 1979, 32 pp (manuscript deposited in VINITI, No 2713-79, 19 Jul 79)

MARKOV, V. V., Institute of Control Problems of USSR Academy of Sciences

[From REFERATIVNYY ZHURNAL, AVTOMATIKA, TELEMEKHANIKA I VYCHISLITEL'NAYA TEKHNIKA, VYCHISLITEL'NAYA TEKHNIKA No 12, 1979 Abstract 12B17 DEP. Author's abstract]

[Text] Problems of operational control of a complex program system oriented toward solution of applied large-dimension problems are considered. The program complex consists of a control program (resident) and a set of load modules which are procedures performing specific calculating functions and which do not contain working files recorded from the dimensions of the problem in their body. Working files are allocated for each procedure during the time of its operation at a free point of the internal storage and are not retained upon emerging from the procedure. Information is exchanged between procedures through common information files stored during problem-solving. The strategy of dynamic distribution of the internal storage belonging to a packet with the absence of fragmentation has been selected and justified. The operating modes of the control program are investigated as a function of the volume of the dynamically distributed region of the internal storage and the composition of the load modules in the procedures circuit. The problem of designation of checking points at a given time interval has been postulated and solved to monitor the quality of the calculation process in each program unit by the control program. References 4. [195-6521]

PUBLICATION ON RESEARCH IN MACHINE TRANSLATION

Moscow ISSLEDOVANIYA PO MASHINNOMU PEREVODU in Russian 1979, pp 1, 2, 318-320

[Annotation and table of contents from book by O. S. Kulagina, Nauka, 1950 copies, 324 pp]

[Text] USSR Academy of Sciences
Order of Lenin
Institute of Applied Mathematics imeni M. V. Keldysha
Scientific Council on the Complex Problem "Kibernetika"

UDC 519.76.651.926; 681.3: 801.5

Kulagina, O. S. Research in machine translation. Moscow, "Nauka," 1979, 324 pp. The book describes the development of research in machine translation (MP). It defines the fundamental concepts in MP, gives the history of MP as a scientific tool, and gives a review of Soviet and foreign MP systems.

The French system of machine translation FR-II, an experimental system of MP from French to Russian is examined in detail. Morphological, and syntactic analysis and synthesis, transformations and the computer realization of the FR-II system are described. Examples of translations performed by the computer are given and their quality evaluated.

This edition is intended for specialists in automatic processing of natural language texts, mathematicians and linguists.

34 tables, 5 illustrations and 124 titles of bibliography. 1950 copies.

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[Excerpts]

Part one

Machine Translation. Concepts, History, Result

[202-9825]

9825
CSO: 1863

USSR

UDC 681.322.01

THE STRUCTURE OF ELECTRONIC COMPUTERS

Leningrad STRUKTURA ELEKTRONIKH VYCHISLITEL'NYKH MASHIN [The Structure of Electronic Computers] in Russian Izdatel'stvo Mashinostroyeniye 1979

MAYOROV, S. A. and NOVIKOV, G. I.

[From REFERATIVNYY ZHURNAL, AVTOMATIKA, TELEMEKHANIKA I VYCHISLITEL'NAYA TEKHNIKA, VYCHISLITEL'NAYA TEKHNIKA No 12, 1979 Abstract 12B16K by S. G. Romanova]

[Text] The principles of construction and the methods of circuit engineering design of computers and digital computer devices are outlined. The structures of general-purpose, mini- and microcomputers are described. Methods of designing the block and schematic diagrams of processors, input-output channels and external control equipment and methods of synthesizing operational and control automatons are considered. The principle of priority of functions with regard to structures is the basis of the method of outlining, from which it follows that the computer structure, i.e., the circuit configuration, is predetermined by the computer function. Unlike the traditional approach when the principles of computer construction and design are considered from components and terminate in a description of the computer as a whole, the material is outlined in reverse order: the computer functions are initially determined, which are then detailed to separate devices, subassemblies and components. It is noted that this procedure of outlining is more efficient because it coincides with the procedure of computer design and simplifies the study of the bases of computer technology, since in this case each circuit engineering solution is perceived as a necessary one predetermined by previous solutions.
[195-6521]

USSR UDC 681.322.068

TECHNOLOGICAL ASPECTS OF DEVELOPING PROGRAM SYSTEMS

Moscow TEKHNOLOGICHESKIYE ASPEKTY SOZDANIYA PROGRAMMNYKH SISTEM in Russian Izdatel'stvo Statistika 1979

FUKSMAN, A. L.

[From REFERATIVNYY ZHURNAL, AVTOMATIKA, TELEMEKHANIKA I VYCHISLITEL'NAYA TEKHNIKA, VYCHISLITEL'NAYA TEKHNIKA No 12, 1979 Abstract 12B60K by T. M. Kuznetsova]

[Text] The main problems arising in development of program systems are considered. Variant networks as a means of determining the justification for a project and operating routes with examples of their practical application are described. The bases and technology of vertical stratification of programs and the instrument complex are outlined. A number of stages of development of programming language is presented and the language of INSTR instrument programming is described. A retrospective analysis of the technological aspects of developing program systems is given. [195-6521]

UTILIZING COMPUTER TECHNOLOGY

Moscow EKSPLUATATSIYA VYCHISLITEL'NOY TEKHNIKI in Russian 1978 pp 2, 230, 231

[Annotation and table of contents from the book "Ekspluatatsiya Vychislitel'noy Tekhniki" by Mikhail Moiseyevich Rapoport, Izdatel'stvo Vysshaya Shkola, signed to press 9 August 1978, 20,000 copies, 231 pages]

[Text] ANNOTATION

In this textbook the author describes the purpose and technical operating characteristics of keyboard and punchcard computers, as well as organizational forms for the use of computer technology. He also present methods and programs for working with computers.

The book also contains an explanation of the principles of accounting, rational calculation methods and procedures, percentage calculations, and proportional division.

This textbook is intended for the training of keyboard and punchcard computer operators in professional and technical education institutions and can also be useful to people receiving professional training while on the job.

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ALGORITHMS

Tashkent ALGORITMY in Russian No 33 1978 pp 2, 92-97

[Annotation, abstracts and author information from the irregularly published periodical "Algoritmy," edited by D.M. Gafurova, Editorial and Publishing Council, Uzbek SSR Academy of Sciences, Tashkent, signed to press 12 May 1978, 500 copies, 97 pages]

[Text] ANNOTATION

This collection of works contains algorithms and descriptions of programs and systems of programs from the Fund of Algorithms and Programs (FAP) of the Uzbek SSR Academy of Sciences' Institute of Cybernetics and Computer Center (IK s VTs AN UzSSR). They are concerned with questions of system and theoretical programming, automation of the programming process, the technology of ASU [automatic control system] software, the automation and optimization of the planning process, applied mathematics, linear algebra, statistics, and so on.

This collection is intended for the use of scientific workers in research institutes and planning organizations, as well as graduate students and students in advanced courses at VUZ's oriented toward economics and mathematics.

The programs can be obtained by sending official requests to the FAP of the IK s VTs AN UzSSR.

Editorial Board: Academician of the Uzbek SSR Academy of Sciences V.K. Kabulov (editor-in-chief), A. Abdugafarov, F.B. Abutaliyev (deputy editor-in-chief), T. Buriyev, F.M. Garayev, S. Karimberdiyeva, N. Mukhidinov, R.A. Sadykov (chief secretary), Corresponding Member of the Uzbek SSR Academy of Sciences A.N. Filatov.

ABSTRACTS AND AUTHOR INFORMATION

UDC 681.3:518.5

REALIZATION OF A DIALOG INTERPRETER OF AN INFORMATION RETRIEVAL LANGUAGE

SHATROV, VALERIY FEDOROVICH, sector chief, Computer Center, TashGU [Tashkent State University], and DRUKH, PAVEL TSALEVICH, student, TashGU.

The authors describe the realization of a dialog system for formulating retrieval inquiries in an automated library complex. They describe a method for optimizing the retrieval algorithm. References 5.

UDC 681.31.01

ON ONE METHOD FOR ORGANIZING INFORMATION FILES

LEVIN, YURIY VIKTOROVICH, division chief, Information-Computer Center, Uzbek SSR Ministry of Industrial Construction, Tashkent.

The author discusses one method of organizing information files that contain both fixed and recurrent data. The structure of the files can be changed at any moment by a user who is not a programmer. The processing programs have the capability of automatically adjusting themselves to a new information file structure. References 7.

UDC 518.5

AN ALGORITHM AND A PROGRAM FOR CLASSIFYING FEATURES BY THE METHOD OF MULTISTEP PROBABILITY ESTIMATION

ABUTALIYEV, FARADEY BASYROVICH, doctor of physical and mathematical sciences, laboratory chief, IK s VTs AN UzSSR, Tashkent, and AKHATOV, YURIY KONSTANTINOVICH, junior scientific worker, IK s VTs AN UzSSR, Tashkent.

The algorithm and the program are intended for the solution of problems having to do with the probability selection of the values of a feature in a regular grid, given its known values at any points in the area and allowing for their interaction. References 2.

UDC 624.073

ON THE QUESTION OF CONSTRUCTING AN ELEMENT RIGIDITY MATRIX

KURMANBAYEV, BALTABAY, candidate of physical and mathematical sciences, department head, TashGU, and POLATOV, ASKHAD MUKHAMEDZHANOVICH, graduate student, TashGU.

The authors describe a technique for constructing an element rigidity matrix with differing numbers of nodes. For the realization of the algorithm they propose a special form of coding for the terms of the interpolation polynomial. References 8.

UDC 519.3

CALCULATING STEADY-STATE FILTRATION BY THE METHOD OF FINITE ELEMENTS

SADYKOV, RAVIL' ABDUGANIYEVICH, candidate of physical and mathematical sciences, IK s VTs AN UzSSR, Tashkent, and USMANOV, KHAKIM KHAMIDOVICH, graduate student, IK s VTs AN UzSSR, Tashkent.

The authors discuss the use of the method of finite elements to solve plane problems of steady-state filtration where boundary conditions of the first, second or third type can be given on the boundary of the area. The variational problem of minimizing the energy functional is reduced to an equivalent problem of the solution of a system of nonlinear algebraic equations. In order to find the solution, the authors use Newton's method in combination with the matrix dispersion method.
The calculation program is written in ALGOL-60 for use with a BESM-6 high-speed computer and is drawn up in the form of a procedure. References 2.

UDC 532.546.013.2

A PROGRAM FOR SOLVING THE PROBLEM OF NON-STEADY-STATE FILTRATION IN TWO-LAYERED, GAS-DYNAMICALLY INTERACTING STRATA

ADYLOV, ANVAROYEK KAYUMOVICH, junior scientific worker, IK s VTs AN UzSSR, Tashkent, and BABAKAYEV, SALIY NAPESOVICH, junior scientific worker, IK s VTs AN UzSSR, Tashkent.

The authors discuss the non-steady-state influx of gas into a central well that is imperfect with respect to the degree of coverage under conditions of hydrodynamic interaction with the adjacent stratum, the filtration parameters of which can be lower by several orders of magnitude than those of the bed being developed. The computational plan for the calculations on a computer is based on the theory of economic plans as it applies to multidimensional (quasi-three-dimensional) boundary-value problems for nonlinear parabolic systems. The authors present the results of computer calculations in the form of tables. The program is written in ALGOL-60 for use with a BESM-6 high-speed computer. References 3.

UDC 518.5.66.081

A PROGRAM FOR CALCULATING THE PROBLEM OF ION-EXCHANGE FILTRATION ACCORDING TO THE SAMARSKIY-FRYAZANOV METHOD

RAKHIMOV, MAKHMUD YADGAROVICH, senior engineer, IK s VTs AN UzSSR, Tashkent.

The author presents an algorithm for calculating the problem of ion-exchange filtration with land improvement by silt deposition. The system of plain differential equations that describes the filtration process is solved by the (Kutt-Merson) method, while the ion-exchange sorption equations are approximated by Samarskiy-Fryazanov's method and the system of

algebraic equations that is obtained is solved by the joint dispersion method. The computation error with respect to the material balance equations is calculated in each temporal layer. References 2.

UDC 626.814:624.824

A PROGRAM FOR CALCULATING RUNNING TIME DURING THE MODELING OF RIVER DRAINAGE

ABDURAIMOV, M., and ALIMOV, SH.A. [no information]

The authors propose a program for calculating wave running time by the dispersion method. It is written in ALGOL-60, for use with a BESM-6 high-speed computer. References 2.

UDC 62-522:628.14/15:681.3

AN INTEGRATED PROGRAM FOR HYDRAULIC CALCULATIONS OF COMPLICATED, MULTIRING WATER SUPPLY LINE NETWORKS WITH SEVERAL FEED-IN SOURCES

SADULLAYEV, RAKHMATULLO SADULLAYEVICH, candidate of technical sciences, laboratory chief, IK s VTs AN UzSSR, Tashkent, and SUKHANAYEVA, LILIYA DZHALILOVNA, graduate student, Tashkent Polytechnical Institute, Tashkent.

This integrated program for hydraulic calculations is intended to be used for the hydraulic correlation of complex, multiring water supply line networks with several water sources and more than 500 sections.
The program makes it possible to correlate the network not only with respect to the rings, but also with respect to selected directions of the flow from one water source to another. The values of the piezometric marks and the free heads are determined at each junction in the network. The program is drawn up in codes used by the M-220 computer and has been registered as a standard one. References 3.

UDC 621.39.052

ON ONE METHOD OF CALCULATING AN INFORMATION TRANSMISSION NETWORK

ADYLOVA, ZUKHRA TUYCHIYEVA, candidate of technical sciences, laboratory head, IK s VTs AN UzSSR, and KABULOV, BAKHROM TAKHIROVICH, graduate student, IK s VTs AN UzSSR, Tashkent.

The authors solve the problem of the distribution of an information flow over communication channels. They present an expression for the maximum value of the intensity of the total flow of information of each priority and the conditions for the use of a communication channel to transmit messages of a given priority. The algorithm is realized in the form of a program written in BASIC FORTRAN for a YeS-1020 computer. References 1.

UDC 338.984+62-5

CALCULATING THE TEMPORAL PARAMETERS OF A NETWORK MODEL

BALAKHONOV, VLADIMIR NIKOLAYEVICH, senior engineer, ASU SPKB [Special Planning and Design Office], IK s VTs AN UzSSR, Tashkent, and VILENCHIK, VITALIY BORISOVICH, candidate of physical and mathematical sciences, software project designer, ASU SPKB, IK s VTs AN UzSSR, Tashkent.

This complex is intended for the calculation of a network's temporal parameters. In addition, when the initial information is given the following types of errors are detected: assignment of two initial network events, assignment of two final events, the presence of a cycle, the presence of truncated events, the lack of an initial event.
The complex consists of seven program units written in FORTRAN-IV for use with a Minsk-32 computer. References 1.

UDC 681.3.06

ALGORITHM AND PROGRAM FOR THE HARMONIC PERFECTION OF THE PROPERTIES AND RELATIONSHIPS OF OBJECTS

AKHMEDOV, ERKIN ISLAMOVICH, senior engineer, IK s VTs AN UzSSR, Tashkent.

The author proposes an algorithm and a program for consolidating and distinguishing harmonic, beautiful and abnormal properties, qualities, things and relationships. He introduces formalized concepts of good, evil, harmony, beauty, abnormality and perfection. He also discusses the systems approach to determining the level of development of objects and their qualities for the purpose of harmonic improvement. References 3.

UDC 330.115:65.012.2

HIGH-SPEED ALGORITHM FOR APPROXIMATING THE ELEMENTS OF A MULTIDIMENSIONAL MATRIX

MIRZAKHMEDOV, ERIK A., chief, Computer Center, Central Asian Railroad Administration, Tashkent

The author describes a high-speed algorithm for approximating the elements of a multidimensional matrix. The algorithm is realized on Minsk-32 and YeS-1022 computers and provides a solution to the problem of correlating technical and State plans for freight shipments on the Central Asian Railroad. The solution time for three-dimensional 10 x 28 x 50 matrices is about 0.5 minutes, while for two-dimensional 50 x 50 matrices it is 0.1 minutes.

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ALGORITHMS

Tashkent ALGORITMY in Russian No 35 1978 pp 2, 99-104

[Annotation, abstracts and author information from the irregularly published periodical "Algoritmy," edited by D.M. Gafurova, Editorial and Publishing Council, Uzbek SSR Academy of Sciences, Tashkent, signed to press 8 December 1978, 500 copies, 104 pages]

[Text] ANNOTATION

This collection of works contains algorithms and descriptions of programs and systems of programs from the Fund of Algorithms and Programs (FAP) of the Uzbek SSR Academy of Sciences' Institute of Cybernetics and Computer Center (IK s VTs AN UzSSR). They are concerned with questions of system and theoretical programming, automation of the programming process, the technology of ASU [automatic control system] software, the automation and optimization of the planning process, applied mathematics, linear algebra, statistics, and so on.

This collection is intended for the use of scientific workers in research institutes and planning organizations, as well as graduate students and students in advanced courses at VUZ's oriented toward economics and mathematics.

The programs can be obtained by sending official requests to the FAP of the IK s VTs AN UzSSR.

ABSTRACTS AND AUTHOR INFORMATION

UDC 541.124/128(075.8)

ALGORITHMS FOR THE MATHEMATICAL MODELING OF THE KINETICS OF CHEMICAL PROCESSES

AYUPOV, RAVSHAN KHAMDAMOVICH, senior engineer, IK s VTs AN UzSSR, Tashkent, and GONTAR', VLADIMIR GRIGOR'YEVICH, candidate of chemical sciences, division head, SKTB [Special Design and Technological Office], Institute of Electronics, Uzbek SSR Academy of Sciences, Tashkent.

The authors explain the algorithms of an automated system for the statistical analysis of experimental data on the kinetics of complex chemical processes. These algorithms include the automatic formulation and solution of all the equations of a problem in statistical analysis in connection with the selection of the mechanism for the occurrence of a chemical process that adequately describes the experimental data. References 4.

UDC 681.142.2

ON ONE VERSION OF THE DISPAK OPERATING SYSTEM FOR PROCESSING INFORMATION WITH DIFFERENT SYMBOL CODINGS

INOYATOV, AKRAM INOYATOVICH, candidate of technical sciences, laboratory chief, IK s VTs AN UzSSR, Tashkent, and ARTYKOV, SAKIDZHAN, and PAK, ALEKSANDR VASIL'YEVICH, senior engineers, IK s VTs AN UzSSR, Tashkent.

The authors describe the operating principles of a new version of the DISPAK operating system for processing information with arbitrary encoding of the symbols. They give a brief description of the MUL'TIDOSTUP [multiple access] "man-machine" dialog system. References 4.

UDC 621.019.3.001.57

AN ALGORITHM FOR FORMING RANDOM STATES OF ELEMENTS OF A COMPLEX CONTROL SYSTEM

ISKHAKOV, DAVRAN MUINOVICH, candidate of technical sciences, junior scientific worker, IK s VTs AN UzSSR, Tashkent, and GLUSHCHENKO, OL'GA NIKOLAYEVNA, engineer, IK s VTs AN UzSSR, Tashkent.

The authors propose a standard procedure for forming random states of elements of a complex control system (SSU) according to the reliability feature: capable of working or failure. Secondary failures of elements are taken into consideration. The procedure can be used when evaluating an SSU's capability for work, reliability level and efficiency. A test problem is solved, using as an example the control system of the drying and absorption process in sulfuric acid production. References 1.

UDC 681.325

MODELING THE CENTRAL CONTROL ALGORITHM FOR THE DISTRIBUTION OF PROBLEMS IN A MULTIPROCESSOR SYSTEM

MUKHAMEDOV, BATYR MANSUROVICH, candidate of technical sciences, senior scientific worker, IK s VTs AN UzSSR, Tashkent, and SAMANDAROV, VAKHITZHAN ISKANDAROVICH, graduate student, IK s VTs AN UzSSR, Tashkent.

The authors discuss a programming model that makes it possible to evaluate the central control algorithms for the distribution of the programmed elements of users' problems among the processors of a multiprocessor computer

system. They calculate the average program implementation time for each variant of the central control process.
The program is written in FORTRAN, for use with a BESM-6 high-speed computer. References 3.

UDC 539.413:681.3.057

PROGRAM FOR AN AUTOMATIC SYSTEM FOR THE DYNAMIC CALCULATION OF THIN, ELASTIC PLATES BY THE METHOD OF VARIABLE DIRECTIONS

BURIYEV, TOZHIBOY, doctor of physical and mathematical sciences, professor, laboratory chief, IK s VTs AN UzSSR, Tashkent.

The author describes the algorithm, block diagram and programming instructions for an automatic system for the dynamic calculation of thin, elastic plates in orthogonal, curvilinear coordinates. The algorithm is based on the finite-difference method of variable directions with second-order accuracy. There is also a discussion of different supporting conditions for a plate: binding, freely resting, free edge. References 5.

UDC 621.01

ALGORITHM FOR CALCULATING THE SEISMIC STABILITY OF CONCRETE DAMS OF THE CANTILEVER TYPE

MUKHUTDINOVA, RAKHIMA KHUSNUTDINOVNA, candidate of physical and mathematical sciences, laboratory chief, Institute of the Mechanics and Seismic Stability of Structures, Uzbek SSR Academy of Sciences, Tashkent, and KARIMOV, ALLOYAR SHERMETOVICH, junior scientific worker, Institute of the Mechanics and Seismic Stability of Structures, Uzbek SSR Academy of Sciences, Tashkent.

The authors present algorithms and a description of a program for calculating the seismic stability of cantilever-type concrete dams on a yielding foundation that have a flat pressure face. An actual accelerogram is used in the calculations. References 3.

UDC 662.276.518:5

AN INTEGRATED PROGRAM FOR CALCULATING THE WEIGHTS OF FACTORS IN POTENTIAL FUNCTIONS THAT ARE USED TO IDENTIFY OBJECTS

SADULLAYEV, RAKHMATULLO SADULLAYEVICH, candidate of technical sciences, laboratory chief, IK s VTs AN UzSSR, Tashkent, and TISHLIKOV, ABDURAIM PARDAYEVICH, graduate student, IK s VTs AN UzSSR, Tashkent.

The authors present an integrated program for calculating the weights of factors that is based on a combined potential function and component analysis method for identifying producing wells that provide the required effect on the development of gas and oil deposits. They present the results of

their calculations and the analysis of these results on a computer for gas and oil deposit development problems. References 3.

UDC 625.282

ALGORITHM FOR CALCULATING OPERATIONAL WORK MEASUREMENT FACTORS IN CONNECTION WITH TRAIN MOVEMENTS

NAZAROV, ABDURAKHMAN PIRMUKHAMEDOVICH, senior engineer, ASU SPKB [automated control system Special Planning and Design office]K s VTs AN UzSSR, Tashkent.

This algorithm is used to determine the operational work measurement factors during the movement of trains with given weight norms, as well as with an average daily amount of movement of freight trains and number of axles on the trains. It is also used to solve problems relating to the prospective development and location of locomotive management projects. References 3.

UDC 621.314.001.57

PROGRAMS FOR ANALYZING TRANSIENT PROCESSES IN LINEAR AND VALVE-TYPE ELECTRICAL CIRCUITS

SMIRNOV, VLADIMIR PAVLOVICH, candidate of technical sciences, reader, TashPI [Tashkent Polytechnical Institute], Tashkent, and AKBAROV, GAFUR AKBAROVICH, junior scientific worker, TashPI, Tashkent.

The authors present algorithms and programs for analyzing transient processes in linear and valve-type electrical circuits. They were developed on the basis of homogeneous canonical and noncanonical bases of nodal voltages. Piecewise-linear approximation of the static characteristic of valves (in the form R_{min}, R_{max}) and an implicit numerical integration formula after Euler are used. The programs make it possible to analyze valve systems with quite large dimensions by using computers from the YeS EVM [Unified System of Computers] series with minimal internal storage capacities. References 4.

UDC 519.854.3

REALIZATION OF A COMPLETELY WHOLE-NUMBER LINEAR-PLANNING ALGORITHM ON A COMPUTER

URAZBAYEV, TEMIRLAN VALIYEVICH, candidate of technical sciences, director, ZAKSHEVSKIY, ALEKSANDR GEORGIYEVICH, division chief, and BIRYUKOV, STANISLAV MIKHAYLOVICH, group leader, GosNIISredazpromzernoproyekt, Alma-Ata.

The authors present a completely whole-integer algorithm for solving the problem of whole-integer programming that distinguishes itself favorably from (Gomori's) method from the viewpoint of realization on a computer. References 5.

UDC 517.949.8

PROGRAM FOR CALCULATING THE DEVELOPMENT PARAMETERS OF MULTISTRATUM GAS DEPOSITS WITH ACTIVE BOUNDARY WATERS

ALIMOV, ISMAILDZHAN, candidate of technical sciences, junior scientific worker, IK s VTs AN UzSSR, Tashkent.

The author formulates the problem and a program (in ALGOL, for a BESM-6 high-speed computer) for calculating the basic development parameters of hydrodynamically nonconnected, multistratum gas deposits that are being exploited with due consideration for their active boundary waters. References 5.

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CSO: 1863

A SYSTEM FOR PROCESSING STATISTICAL INFORMATION ON A COMPUTER

Moscow SISTEMA OBRABOTKI STATISTICHESKOY INFORMATSII NA EVM in Russian 1977 pp 2, 7, 207-208

[Annotation, excerpt from introduction and table of contents from the book "Sistema Obrabotki Statisticheskoy Informatsii na EVM" by Vera Vladimirovna Braga and Tamara Petrovna Panyushkina, Izdatel'stvo Statistika, signed to press 22 June 1977, 24,000 copies, 208 pages]

[Text] ANNOTATION

In this book the authors explain the principles of the planning and creation of an automated state statistical system (ASGS) and describe its interaction with other automated systems.

Questions on the creation of classifiers for statistical information and the standardization of the forms of statistical documentation are stated in accordance with the ASGS's requirements.

This handbook is intended for workers at computer installations in the USSR TsSU [Central Statistical Administration] system, as well as those in other ministries and departments.

It can also be useful to specialists who are engaged in organizing and planning automatic control systems.

INTRODUCTION

During the development and introduction of an ASU [automatic control system] there can arise a series of difficulties that sometimes make it impossible to obtain the necessary efficiency. This happens frequently where they are created without the proper degree of preparedness: without improving the production processes, planning methodology and material and technical supply system, and without the necessary attitude toward personnel and materiel. First of all, the leader of the enterprise or organization must be interested in the creation of an ASU. It is also necessary to retrain the personnel for the organization of the ASU. In order to obtain

the maximum benefit from the use of a computer, the control workers must eliminate a psychological barrier. During the creation of an ASU, such an important question as investigating the information base (as a result of which the connections between separate problems are found, so that they can be combined into complexes) is avoided. It is now clear that the proper effect from the introduction of an ASU is obtained only when there is an integrated approach to the solution of problems; this is particularly important when the problems concern prospective planning and operational control.

In some cases problems that are solvable with the help of punchcard equipment, without expanding the development program and using the automated data bank, are "blindly" assigned to a computer. Until now there have been no clearcut criteria defining the parameters for processing individual problems with the help of different classes of computer equipment.

There are also several shortcomings in the organization of computer software. The standard programs are poorly prepared; programs are frequently duplicated by different organizations, methods for automating programming are used poorly, and the training of programmers is inadequately organized. The USSR Council of Ministers' State Committee on Science and Technology has approved the software programs for the computers being produced at the present time. This means that the user receives guaranteed software programs together with the computer. An integrated plan of projects for creating software for the YeS EVM [Unified System of Computers] machines has also been approved. The autonomously financed Tsentrprogrammsistem scientific production association has been set up in Kalinin. This specialized organization is a base for the development of packages of applied programs that can be used by different computer installations throughout the country.

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PUBLICATIONS IN CYBERNETICS

Moscow ALGORITMY I PROGRAMMY in Russian No 1, 1980 pp 3-160

[Following is a list of entries in ALGORITMY I PROGRAMMY (Algorithms and Programs), a bibliographic publication GPNTB SSSR. This listing is from Vol. 1, No. 1, 1980]

[Excerpts]

3. Issues in the modeling of complex systems/Ukrainian Academy of Sciences, Institute of Cybernetics--Kiev, 1979-92 p.

From contents: Y. L. Sokolovskiy. An engineering approach to the selection of configurations of one class at an early stage of design [NEDIS, BESM-6], pp 3-15; I. G. Kolosovskiy, S. A. Petrosyan. On the processing of lists in the language PL/1, pp. 25-31; S. S. Azarov. On the modeling, using the facilities of GASP-IV, of a single generalized problem in the management of stock, pp. 32-39; S. S. Azarov, M. A. Sakhnyuk, A. V. Shemshur. The use of the GASP-IV package in the Operating System of the Unified System Computer, pp. 39-48; A. G. Akhlamov, Yu. B. Pigarev. On the construction of interactive problem-oriented systems for modeling discrete processes. [POSIMEYA language], pp. 49-56. A. G. Akhlamov et al. Methodological aspects of the construction of simulation models in the GPSS/FORTRAN modeling system. [Unif. Syst. Comp.], pp. 56-63; V. G. Kvachev, L. P. Yakovenko. On special projects in simulation models of data processing systems. [NEDIS], pp. 64-72; V. A. Pepelyayev. Issues in the automation of the construction of tests for combination circuits by means of the NEDIS [BESM-6], pp 73-79; V. A. Pepelyayev. Several issues in the modeling of combinative circuits with faults by means of the NEDIS language. [BESM-6] pp 80-88.

8. Catalogue of the centralized store of methodological material; Compiled on 1 Jan 1979/Min. of Instrument Building, Means of Automation and Systems of Control of the USSR. Soyuzsistemprom. Sci-indust. Assoc. "Tzentrprogrammsistem."--Kalinin, 1970-40 pp.

The store contains methodological materials (MM) relating to designing Automated Control Systems (ASU), improving the organizational structure of systems of control of projects taking into account the possibilities of

contemporary means of automated control etc. Provision of organizational users of MM is effected by contract for subscription to the MM of a certain series, by one-time requests based on a bonded letter.

10. Komadrovskiy, V. G. Theory of computer systems. Part 2. Computer systems, working in parallel modes: Lecture synopsis--Moscow, 1979--76 pp. Super heading: Moscow Instit. Petrotech. and Gas Industry. Bibliog. 8 titles.

14. A calculation of the efficacy of multimachine computer complexes/ B. Ya. Nadler, I. Z. Patratiy, A. I. Stepin, S. A. Khramov.--In bk: The creation of a Republic-wide automated system of control/Sci. Res. Inst. of Design. Kishinev, 1979, pp 116-124.--Bib: 5 titles.

Obtains the functions which permit a rational selection of the composition of a collective use computer center and the evaluation of the expenditures for its creation and use.

18. The technical resources of mini- and micro-computers/Ukr. Acad. Sci., Sci. Counc. on Prob. "Kibernetika." Inst. Cyber.--Kiev, 1979--92 pp. Biblio. at end of articles.

A description of the architecture and structure of microprocessors and micro-computers and systems based on them. Issues relating to the automation of a scientific experiment, an algorithm for solving finite-difference equations and its use in digital nets are considered.

20. Yakubaytis, Z. A. The architecture of open systems.--Riga, 1979--59 pp--(Preprint/Latvian Acad. Sci. Inst. Elect. and Comput. Techn; TV RO-8). Biblio: 6 titles.

The logical and program structure of open systems, including a seven level model, a description of each level and requirements on the system records.

45. Vlasov, A. I. An algorithm for the solution of large low density systems of linear algebraic equations--Automation of planning in electron: Repub. Interdepartmental Sci-Tech. Collect., 1979, Vol 19, pp 3-6--Biblio: 4 titles.

An algorithm is realized in ALGOL and FORTRAN and used in an experimental complex of programs MTM-222 and in a system of programs for the analysis of SPARS radioelectronic circuits in combination with procedures for solving large low-density systems of linear algebraic equations with real and complex non-zero coefficients.

53. Paskonov, V. M., Roslyakov, G. S. The architecture of a package of applied programs for the solution of problems in aerodynamics--comput methods and program: Col. Works/Moscow State Univ./Sci. Res. Comput. Inst., 1979, Vol 30. Numerical methods in the mechanics of continua, pp 140-157--Biblio: 2 titles.

The organization of the package makes it possible to broaden its contents--increase the number of programs, edit programs and store the data for numerical calculations. All components of the package are written in generally accepted, standard programming languages (e.g., ALGOL and FORTRAN), which makes it possible to use the package on different computer models.

69. A package of applied programs "System of automated planning of technological processes" (PPP "Tekhnologiya") on the basis of Disk Operating System of the Unified System: Short description of use/USSR Min. of Instrument Building, of Automation Devices and Control Systems. Soyuzsistemprom. Sci.-Indust. Assoc. "Tzentroprogrammsistem."--Kalinin, 1979--6 pp.

Run time of the programs of the package realized in COBOL, with output on the Alphanumeric printer of operational and route maps of the mechano-processing of five components is 15 min. Address questions about the acquisition of the package to section 214 at the address: 170023, Kalinin, Zhdanova St, 10, Tel: 4-44-94.

88. Tabarnyy V. G., Shabel'nikova, D. G. An algorithm for arrangement of the logical elements of a MDP (microchannel disk) BIS (large scale integrated microcircuit) on a surface.--The Automation of Design in Electronics: Repub. Inter-Agency Sci.-Tech. Collect., 1979, Vol. 19, pp. 52-57.--Biblio: 2 titles.

The algorithm is realized in the program PLACE and contains ca. 700 statements in the PL/1 language. The program is included in the software of an interactive system for automated planning of MDP BIS.

104. Interactive applied programs in the SETL language/V. G. Glagoleva, T. A. Vaynshteyn, A. V. Velichko, et al.--Novosibirsk, 1979.--27 p. (Preprint/Siber. Dept. USSR Acad. Sci. Comp. Cent.; No. 170. Educ. Informat. Sci; Vol. 13).--Biblio at end of chaps.

105. Levin, D. Ya. An experiment in the use of a very high level language (several results)--Novosibirsk, 1979--35 pp. (Preprint/Siber. Dept. USSR Acad. Sci. Comp. Cent.; No. 197, Project SETL; Vol. 4) Biblio.: 26 titles.

106. Cheblakov, V. G. The principle of expandibility of programming systems as a method of increasing efficacy.--Novosibirsk, 1979.--18 pp.--(Preprint/Siber. Dept. USSR Acad. Sci. Comp. Cent.; No. 180. Project SETL; Vol. 3)--Biblio: 13 titles.

Considers approaches to increasing the efficacy of planning programming systems and issues in the realization of fixed data types. Focus moves from the planning of the architecture of the system to mechanisms for expanding and describing the process of development of the system. Problems of realization are considered in the order in which they arise and are solved at different stages of the creation and development of the system of programming. The first stage consists of a precise description of semantics of the language, which to a great extent is determined by the

fixed data types. The second stage is the creation of the minimal nucleus of the system satisfying the given specifications. Later there takes place an expansion of the semantic basis of the system because of the inclusion of new variants of representations and realizations of the abstract types of data taking into account the class of executable programs; issues related to the engineering characteristics of the semantic base; the selection of appropriate representations for the concrete objects of the program.

115. Voskoboynikov, Yu. E., Itskovich, Ye. I. A package of subprograms for the construction of smoothing cubic splines. Materials on computer software.--Novosibirsk, 1979--29 pp. (Preprint/siber. Dept. USSR Acad. Sci. Instit. Thermophysics; No. 46-79). Biblio: 6 titles.

Gives description and texts of a FORTRAN subprogram for smoothing and differentiating tabular functions.

126. Agapov, A. V., Kolosov, B. I., Churayev, R. S. The injection of an electronic beam into a plasma half-space: numerical modeling of a stationary process.--Moscow, 1979.--46 pp.--(Preprint/USSR Acad. Sci. Inst. of Space Research; No. PR-509). Biblio: 9 titles.

The construction of numerical methods is based on the theory of iteratively regularized difference circuits, providing convergence of solution in Sobolev's metric. As a result of the calculations performed, oscillation spectra and the functions of distribution of particles in the beam are obtained for large typical relaxation lengths. The derivation of the fundamental equations and the text of the FORTRAN program are given.

131. Anisimov, V. I., Sokolova, V. V. A problem-oriented package of applied programs (POPPP) for automated design of electronic circuits.--Proc. of Leningrad Electrotech. Inst., 1979, Vol. 235, Automation of design and radioelectron. and instrument building, pp. 3-7--Biblio: 3 titles.

The POPPP in FORTRAN and the Unified System Computer assembler have a modular structure which makes it expandable.

133. Babikov, P. Ye. Subprograms for the construction of a system of orthogonal curvilinear coordinates on an arbitrary surface with continuous curvature.--Trans/Cent. Aerohydrodynam. Inst. 1979, Vol. 2003, Aerodynam. of Heating at Supersonic Speeds of Flow: Collec. of arts. pp. 35-78.

FORTRAN-programs GEOPOL, FULER, LAME for the construction of geodesic polar coordinates, calculation of Lame coefficients and matrices for conversion of data of external flow into new coordinates.

134. Babikov, P. Ye. A program for the calculation of thermophysical parameters of actual air.--Trans/Cent. Aerohydrodyn. Inst., 1979, Vol. 2003. Aerodynam. Heating at Supersonic Speeds of Flow: Collect. art., pp. 147-159--Biblio: 5 titles.

FORTRAN program for computation of the values approximating functions and coefficients of transfer of air, with error no worse than 1% in the range of variation of pressure of $10-10^7$ Pa. and of temperature of 100-6000 K. The time for this calculation is ≤ 1 msec. per calculation point with a computer speed of 1 million operations per sec., the size of working memory being 500 cells.

146. Leont'yev, V. A., Deynega, Ye. P. Methodology for preparing initial information for calculation of the motion of a flexible blade of the main rotor of a helicopter--Moscow, 1979.--17 pp.--Trans/Cent. Aerohydrodyn. Inst., Vol. 2023.

Gives a FORTRAN program for calculating the motion of a blade with a hinged and rigid fastening to the bushing of the main rotor. The results of the calculation for the blade of the Mi-8 helicopter confirm the fact that the given method is accurate enough for practical use.

178. Zadiraka, V. K., Mikhalevich, V. S., Sergiyenko, I. V. Issues in the development of software for solving problems in the statistical processing of data.--Kiev, 1979--47 p. (Preprint/Ukr. Acad. Sci., Inst. Cyber: No. 79-50).--Biblio: 19 titles.

Describes algorithms for evaluating probability characteristics of random quantities and processes in FORTRAN (for the BESM-6 computer) and on the Unified System computer. Considers the distinguishing features of the methods of statistics, consisting of the selection of the most effective evaluations and in the description of all possible errors in the computer processing of data.

186. Aksenov, V. V., Voronin, Yu. A., Mazhul', G. R. A package of applied programs of the subsystem "Progress of work report" (Formalization of control of scientific research work and experimental design work).--Novosibirsk, 1979--29 pp. (Preprint/Siber. Dept. USSR Acad. Sci., Comput. Cent.; No. 193).--Biblio: 3 titles.

Gives a FORTRAN-program in the form of a listing of the FORTRAN translator. Size of magnetic core storage 256k bytes with three disk drives.

194. Ivanov, B. V. Development of a program of statistical modeling of nonlinear effects in a mosaic of an electronic-semiconductor apparatus.-- Proc. Leningr. Electrotech. Inst., 1979, Vol. 235. Automation of planning in radioelectron and instrument building, pp. 74-78. Biblio: 10 titles.

Describes a FORTRAN program of statistical modeling, taking account of the influence of diffusion and recombination on the magnification factor of the mozaic. Gives calculations illustrating several possible programs.

203. Razevig, V. D. Interactive programs for calculating electronic circuits on a computer.--Trans. Mosc. Elect. Inst., 1979, Vol. 418. Methods and apparatus for producing and processing radio signals: Thematic coll., pp. 154-156.--Biblio: 4 titles.

Basic requirements for interactive programs. Describes a program in BASIC, the calculation of frequency and transient characteristics of electronic circuits, realizing as a dialogue in the form of questions and answers. Key words. BASIC, HP-2000, interactive programs, time sharing modes, linear electronic circuits.

209. Boyarov, O. D., Kleshchev, A. S., Lifshits, A. Ya. REAL-a programming language of applied systems of artificial intelligence: Preprint--Vladivostok, 1979,--20 pp. Overheading: USSR Acad. Sci. Dal'nevost. (Far Eastern) Sci. Cent. Inst. of Automation and Processes of Control. Biblio: 12 titles.

Describes the problem-oriented REAL language for systems based on familiar formalism for the representation of knowledge--declarative (predicate calculus), semantic, procedural (actors) and synthesized declarative-procedural (frames).

210. Vorontsov. V. N. The "Interactions" system of mathematical methods for computer modeling. Elements of a theory.--Moscow, 1979,--59 pp.--Overheading: Inst. Probs. Cont. Biblio: 40 titles.

Problems in the synthesis of models of complex systems in research and development work; prospects for development of theoretical studies and the solution of practical problems using mathematical methods of modeling. Considers elements of a general theory of interaction.

211. Vorontsov, I. N., Greshilov, M. M. The "Interactions" system of mathematical methods of computer modeling. The language of the system. The version realized on the VM-3. Library of operators and procedures: Commun. 1.--Moscow, 1979,--37 pp.--Overheading: Inst. Prob. Cont. Biblio: 5 titles.

Description of the operators and procedures, included in the library of the "interactions" system (machine version realized on the VM-3): functional operators, operators for integration, operators analyzing subsystems, operators for input of initial data, [word illegible] functions, operators for changing the features of elements in the process of their functions.

212. Vorontsov, I. N., Greshilov, M. M. The "Interactions" system of mathematical methods of computer modeling. The language of the system--Machine version realized on the VM-3. Moscow, 1979,--75 pp.--Overheading: Inst. Prob. of Contr. Biblio: 3 titles.

Fundamental syntactic constructions of the language, making it possible to describe a model of complex systems and organizational procedures of

modeling. In the description of the modeling complex, intended for input into a concrete computer, there are specific operators for interaction with a concrete operational system, usable at a given moment in the computer complex.

213. Vorontsov, I. N., Greshilov, M. M. The "Interactions" system of mathematical methods for computer modeling. Language of the theory and language of the system. Moscow, 1979,--47 pp.--Overheading: Inst. Prob. Cont. Biblio: 13 titles.

Ways to generate syntactic constructions, corresponding to the fundamental concepts of the theory and individual instances of the description of physical processes, characteristics of the organization of the study of the models.

217. Kutsenko, A. V., Stupin, Yu. V. Automation of scientific research based on the FIAN computer complex.--Trans./USSR Acad. Sci. Phys. Inst., 1979, Vol. 112. Systems of automation of sci. res. and their software, pp. 3-7. Biblio: 5 titles.

Principles of construction of systems of automation and processing of data from physics studies, basic trends in automation, the structure of software on the mini-computers TRA/1 (Elektronika-1000I), PDP-11, Nova-2, M-6000.

218. Kutsenko, A. V. A model of a system of complex automation of large research installations on the basis of a mini-computer net.--Trans./USSR Acad. Sci., Phys. Inst., 1979, Vol. 112. Systems of automation of sci. research and their software, pp. 8-12. Biblio: 8 titles.

The model is based on the principle of multi-user computers and multiprocessor work with a common pool of users. Spatial-temporal transformations of computer resources take place by means of sequential ring mains. An essential condition for the realization of the system is the use of the CAMAC system.

221. A multicomputer system of automation of a powerful laser apparatus, "Del'fin," for purposes of study of thermonuclear synthesis (project)/ N. G. Basov, O. N. Krokhin, A. V. Kutsenko et al. Trans./USSR Acad. Sci. Phys. Inst., 1979, Vol. 112. Systems of automation of sci. research and their software, pp. 13-48. Biblio: 7 titles.

The "Del'fin" apparatus is a complex automation project and contains ∿30 points of control, from which information is obtained or over which control is exercised. The system of automation is based on the use of several mini-computers, working for a common pool of users. The system has been constructed according to the AMA ideology with the use of sequential mains and a crate system (translation unknown).

223. An automation system for the crystallization apparatus "Sapfir"/Kh. S. Bagdasarov, A. I. Bardybakhin, Ye. D. Bulatov et al.--Trans./USSR Acad. Sci. Phys. Inst., 1979, Vol. 112. Systems of automation of sci. research and their software, pp. 97-102. Biblio: 3 titles.

Requirements for systems of automated control of schedules of work of crystallization apparatus. Cites systems constructed on the basis of digital technology using mini- or micro-computers of standard modules of the CAMAC type. Describes the initial data on the basis of which the configuration of digital system of automated regulation was constructed, the work algorithm of the system and its software.

224. Devices and methods for putting together a PS-300 UVK (process control computer system): Methodological instructions. Sect. 2. Software/Tbilisi, Sci. Res. Inst. of instrument building and automation devices, Sci-indust. assoc. "Elva"--Tbilisi, 1979--245 pp.

Purpose, description and area of application of internal and applied software on the Mnemonic Code PS-300. Gives short functional and technical descriptions of the drives, control problems, packages and individual modules.

225. Shevchenko, A. N. Programming of the structure of solution of boundary-value problems in the RL-I language.--Khar'kov, 1979, 24 pp. (Preprint/Ukran. Acad. Sci. Inst. Probs. of Machine building; No. 132)--Biblio: 6 titles.

Description of the syntax, semantics and pragmatics of a specialized programming language, RL-I, which automates the process of programming and solution of boundary-value problems in mathematical physics. Examples show methods for programming standard solution structures, realization of the program in the representation of geometric information in analytic form and the processor for translation from the RL-I language.

247. Anistratenko, A. A., Migulyan, Yu. P. Nazarov, A. N. Input of information from a digital multichannel tape recorder to a M-4030 computer. Research in the Geomagnetism, Aeronomy and Physics of the Sun/Siber. Dept. USSR Acad. Sci., Inst. Terrest. Magnetism, Ionosphere and Radio Wave Propagation, 1979, Vol. 49, Physics of the sun, pp. 168-170.

A system has been created in standard CAMAC which makes it possible to connect up to 24 terminals and to organize their interaction with the computer in a multiplexor mode.

249. Catalogue of the central store of algorithms and programs of automated systems of control. Listing for the 4th quarter of 1978/Minist. Instrument building, Automation Devices and Control Systems of the USSR. Union of Indust. Systems. Sci-indust. Assoc. "Tzentrprogrammsistem"--Kalinin, 1979--41 pp.

250. Package of applied programs (PPP) for "Development and incorporation of programmed devices, providing preparation and processing of information among remote projects using communication channels" (PPP software system for transmission of information M-5010) on the basis of the DOS PVK (Disk operating system punchcard computer complex) M-5010: A short description of its use/Minist. of Instrument building, Automation Devices, and Control Systems of USSR Union of Indust. Sys. Sci-indust. Assoc. "Tzentrprogrammsistem"--Kalinin, 1979--8 pp.

255. Gorelik, A. M., Kharitonova, Ye. B. Study of the influence of optimizing transformations on the efficacy of programs, generated by translators--Moscow, 1979--15 pp.--(Preprint/USSR Acad. Sci. Instit. App. Math.' No. 154--Biblio: 10 titles.

A comparative analysis of optimizing versions of the FORShAG translator on the basis of the ALMO language, and earlier versions of FORShAG and the FOREX translator.

257. Zakharov, A. Yu. Some results of a comparison of the effectiveness of solutions to systems of ordinary differential equations.--Moscow, 1979--32 pp.--(Preprint/Inst. App. Math. No. 125). Biblio: 25 titles.

For a predetermined range of accuracy a comparison of nine programs is made on the solution of 25 model problems on a BESM-6 computer.

258. Zel'dinova, S. A. The program resources of the DISPAK operating system for work with 29 megabyte disks.--Moscow, 1979--7 pp.--(Preprint/ USSR Acad. Sci. Inst. App. Math.; No. 149)--Biblio: 2 titles.

259. Kopytov, M. A., Tyurin, V. F. The BAMOS programming system--DISPAK for the BECM-6: Users handbook.--Moscow, 1979--117 pp. (Report on computer software/USSR Acad. Sci. Inst. App. Math Comput. Center) Biblio: 44 titles.

A combination of two systems of internal software for the BESM-6: VAMOS (a development of the specialists of East Germany) and DISPAK, provides for users in the USSR the possibility of using, without any adaptions, programs and applied program packages developed in East Germany.

262. Markov, Yu. V., Savochkina, O. A., Temnoyeva, T. A. The TERM terminal system for the BESM-6.--Dimitrovgrad, 1979--14 pp. (Preprint/ Sci. Res. Inst. Atom Reactors; No. 6(365))--Biblio: 9 titles.

The TERM system allows the user, in an interactive mode, to edit files and submit jobs in a batch mode to the DISPAK operating system. The system is realized in the BYeMSh macrocode and uses 10 sheets of working memory.

263. Nazarova, M. V., Solntsev, V. A. An evaluation of the effectiveness of an algorithm for computing the strength of a space charge for cylindrical areas--Proc. Lening. Electro. Tech. Inst., 1979, Vol 235. Automation of planning in radio electronics and instrument building, pp 88-91--Biblio: 6 titles.

Compares the effectiveness of three different programs for solving Poisson's equations in cylindrical areas of simple geometry on a BESM-6 computer. Solution time for direct methods is ~0.97 for each 100 nodes of the net which corresponds to two iterations of the method of depth-breath search.

264. Onopchuk, Yu. N. Features of the construction on a simulation system for study of physiological processes with a digital computer.--Cybernetics and Comput. Tech. Repub. Interag. Collect./Ukr. Acad. Sci. Inst. Cyber., 1979, Vol 45. Inter. Cyber., pp 103-106--Biblio: 7 titles.

A simulation model on the BESM-6 computer studies the dynamics of mass transfer of gases in the organism of humans and sea animals in the context of various disturbances in the environment using as a synthesizing medium a model of the organism itself.

271. Machine graphics and their use: collect. sci. studies/Siber. Dept. USSR Acad. Sci. Comput. Cent.--Novosibirsk, 1979--137 pp--Biblio at end of arts.

A new graphic system SIGAM is constructed according to modular principles and posseses a well-developed system of graphic archives and libraries. The system of control of output takes place through direct output on a graphic information apparatus. An interactive graphic channel has been developed. Adaptation of the SMOG system to the Unified System Computer, M-4030 and BESM-4M has been accomplished. A representation of surfaces of revolution and methods for using the SMOG system have been used for output of meterological information.

278. Fronchak, V. An applied program package on the method of branches and boundaries as one of the trends in the programming realization integration of planning of work in discrete production.--Sci-Stud./Mosc. Inst. Control, 1979, Vol 143. Theory of Automated Systems of Control, pp 156-159.

282. A realization of applied programs on the Unified System Computer/V. P. Kotok, A. M. Mikhaylov, A. V. Tartakovskiy et al--Novosibirsk, 1979--18 pp--(Preprint/Siber. Dept- USSR Acad. Sci Comput. Cent.; No 171. Educ. information sciences, Vol 4). Biblio at end of chapt.

291. A package of applied programs. "A system of communications among information bases" (PPPSSIB) on the basis of the Unified System Operating System: A short description of its use./Min. of Instrument Building, Automation Devices and Systems of Control of the USSR Union of indust. systems. Sci-Indust. Assoc. "Tsentrprogrammsistem"--Kalinin, 1979, 8 pp.

The PPPSSIB is designed for transformation of the S1OD-1, S1OD-2 and S1OD-05 data bases into data bases handled by resources of the ISU-1 PPP.

301. The "Spros" package of applied programs on the basis of the Unified System Operating System: A short description of its use/Min. of Instrument Building, Automation Devices and Control Systems of the USSR. Union of Indust. Syst. Sci-Indust. Assoc. "Tsentrprogrammsistem."--Kalinin, 1979--15 pp.

Questions about obtaining the package should be addressed to division 214 at the address: 170001, Kalinin, Proletarka, 94, telephone: 2-28-36

304. A catalogue of the centralized store of algorithms and programs for automated systems of control (TsFAP ASU): Listing for 1st quarter of 1979/ Minist. of Instrument Building, Automation Devices and Control Systems of the USSR. Union of Indust. Syst. Sci-indust. Assoc. "Tsentrprogrammsistem." --Kalinin, 1979--29 pp.

315. Software for the automated subsystem for research on the BOR-60 reactor using a computer--Dimitrovgrad, 1979--9 pp--(Preprint/Sci. Res. Inst. of Atomic Reactors; No 29 (388)) Biblio: 2 titles.

316. Recording and processing on a computer of physical information obtained at the Tyan'-Shan'skiy complex installation for the study of extended atmospheric showers of cosmic rays/V. S. Aseykin, V. K. Adamenko, O. G. Golovanov et al. Trans/USSR Acad. Sci. Phys. Inst. 1979, Vol 112. System of automation of sci. research and their software, pp 49-63, Biblio: 3 titles.

The system for recording and processing data on a computer contains a device for collection of data from 2500 detectors of charged particles and writing of the data on magnetic tape and devices for reproducing data and inputting them to the computer. The entry of data takes place by the method of return to zero along four tracks on tape of 2, 6 and 6D of 6.25 mm width. With a writing density of 7 lines/mm and speed of tape movement of 762 mm/sec there is full compatibility with tape recorders. Devices for the input of data into the BESM-4, M-220, Nairi and Nairi-2 computers have been developed.

317. Comparison of characteristics of translators from FORTRAN/USSR Acad. Sci. Inst. App. Math.--Moscow, 1979--15 pp--Biblio: 7 titles.

320. Bogdanov, A. I. Methodology and results of calculation on the computer of statistical stability of SVP (Vessels on an air cushion) of a Skeg type (translation unknown)--Trans/Cent. Sci. Res. Inst. of the Maritime Fleet, 1979, Vol. 246. Strength of the hull and stability of the vessel, pp. 97-103--Biblio: 4 titles.

Describes the "Kren" program ("a program for calculating boarding, stability and unsinkability of SSVP (skeg vessels on an air cushion) in the AKI-T language. Calculation time of the diagram of stability of the SSVP on the Minsk-22M computer on the average: by the air cushion method is 30 min., by the displacement method is 30-40 min. On the Minsk-32 computer the calculation time is 3-4 times shorter.

321. Methodological directions for using mathematical economic methods and models for future planning of the development of associations (enterprises) of sectors/Cent. Sci. Res. Inst. "Electronika."--Moscow, 1979--356 pp.--Biblio: 13 titles.

Description of mathematical-economic models and methods of solution of problems in five-year and long term planning of the development of industrial sectors; sets of programs for solving these problems on the Minsk-32 computer; recommendations for their use and preparation of data for the calculations.

324. An automated system of control for filling out documents/Yu. V. Zasykhin, Yu. V. Ivanov, Yu. B. Pod"yachev, V. N. Shamarayev.--Moscow, 1979--66 pp. (Methodological materials. Series: Economics and Systems of Control/Cent. Sci. Res. Inst. "Elektronika," Vol. 3 (74)).

Principles of construction of automated systems of control for filling out documents (ASKI) as subsystem of the automated system of control; the work of the ASKI (input and processing of initial information, printing the results); order of input in the operation of the ASKI. Gives ASKI programs in the Analitik language, instructions to operators and test examples.

329. Prokof'yev, V. A. Programming on mini-computers--Moscow: Sov. Radio, 1979--79 pp.--Biblio: 5 titles.

Manual in programming for the mini-computers Elektronika-C50 and ISKRA-125 for beginning programmers. Describes their technical characteristics and programming devices.

330. Interactive system of representing graphic information/S. P. Vikulov, V. V. Romantsev, A. V. Foygel', O. Ye. Shushpanov--Moscow, 1979--28 pp. (Preprint/USSR Acad. Sci. Inst. Radiotechn. and Electronic, No. 18 (274))--Biblio: 1 title.

The system serves a group of mini-computers Wang-2200 VP--graph constructor TEKTRONIX-4662:--graph display TEKTRONIX-4000 and is intended for representation in graphic form of data which can be given in the form of a table (disk file) or in the form of a function (program for its computation).

339. Kudryashov, A. B., Panin, V. F. Study of the stress-deformed state of a three layer panel with a honeycomb filler with a crosswise bend.--Trans./Cent. Aerohydrodyn. Inst., 1979, Vol. 2012, pp. 66-73.--Biblio: 3 titles.

Influence of various constructive solutions on the stress deformed state of a panel in the end zone. The study is based on calculation by the method of the final element and an experiment. All calculations were performed with the help of a complex program for the ICL-4 computer.

344. Mel'nichenko, I. M., Shkobin, N. Yu. The preparation of photo-originals of printed circuits on the semiautomatic ADMAP-Dubna, 1979--15 pp. (Commun. United Inst. of Nucl. Res., No. 11-12291)--Biblio: 6 titles.

The structure and operating principle of the FOTON program for the PDP-84 computer. The obtaining of a set of control tapes, serving the photo-process, optimization of the independent working of the photohead. The program is equipped with a system of diagnostics helpful in use.

348. Batanov, L. A., Kovrigin, B. N. Construction of models of digital elements in a system of automated planning of digital computers. Eng-math. methods in physics and cybernetics/Moscow Eng-Phys. Inst., 1976, Vol. 5, pp. 56-59. Biblio: 4 titles.

A set of program models on an M-220 computer arbitrary digital structures containing up to 1500 elements in an interval in 10^7 units of time. The modeling of a digital device containing $\sim$500 logical and flip-flop elements required 14 min. of machine time.

349. Bel'man, L. B., Lavrikov, S. A. A study of algorithms of control of a random parameter by the method of statistical modeling.--Eng-math. Methods in Physics and Cybernetics/Mosc. Eng-Phys. Inst., 1976, Vol. 5, pp. 59-64--Biblio: 5 titles.

A mathematical model of a system defines and studies the criteria of its functioning, defines the laws governing the distribution of the parameter with various correlated functions for various strategies, of the functioning of the system and for an arbitrary algorithm for computing the correcting signal, derives the dependence of the criteria introduced on the parameters of the random process and the temporal intervals with accuracy of 0.2%. The model is realized on the M-220. The program occupies $\sim$1000 cells of memory. The time to obtain one value of M or K$\leq$30 secs.

363. The modeling of one problem in the control of a movable object using the NEDIS language/Yu. I. Grinenko, N. A. Zelenskaya, A. B. Shemshur, T. N. Yarovitsaya.--Kiev, 1978,--18 pp. (Preprint/Ukr. Acad. Sci. Inst. Cyber.' No. 78-40).

Gives a program in the NEDIS language for modeling of one of the problems of control of the flight of a flying apparatus. The results of the modeling showed the advantages of the NEDIS language in comparison with other languages.

376. Translation of the Applied Program Package SIOD-2 from NMD Unified System--5056 to NMD Unified System 5061. Recommendations for use/Min. Instrument building, Automation Devices and Control Systems of the USSR. Union Indust. Syst.-Sci.-Indust. Assoc. "Tsentrprogrammsistem"--Kalinin, 1978--10 pp.

378. PROChNOST'-75--A system of software for calculating spatial constructions. Part 1 General description of the system: Users' manual/ Ukr. Acad. Sci. Special Design Bureau for Math. Machines and Systems of Inst. Cyber., Ukr. Repub. Store of Algorithms and Programs.--Kiev, 1978--178 pp.--Biblio: 21 titles.

Describes the structure, purpose and principles of construction of the fundamental subsystems of the set of applied programs for calculating spatial constructions in FORTRAN, the set of problem oriented languages and the supporting translator and subsystems for graphic representation of information and an interactive monitor.

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CYBERNETICS IN THE SERVICE OF COMMUNISM. VOLUME 9. INFORMATION AND CONTROL

Moscow KIBERNETIKU - NA SLUZHBU KOMMUNIZMU. TOM 9. UPRAVLENIYE I INFORMATSIYA in Russian 1978 signed to press 13 Oct 78 pp 5-10, 109-128, 237-239

[Annotation, introduction, one chapter and table of contents from book edited by I. Berg, Energiya, 2300 copies]

[Text] ANNOTATION

This book contains survey-type, problem-oriented articles on a number of basic areas of theoretical, technical and applied cybernetics. A study is made of some of the problems of the mathematical problematics of cybernetics (queuing theory) and also the theory of finite automata, finite control, adaptive systems and vector optimization. The results obtained in information theory and its applications are analyzed in a separate article. The problems of computer engineering are represented by an article on uniform computer structures, media, systems and nets. In the article on experimental planning the methods of this area of cybernetics are investigated as a way to improve the efficiency of basic and applied research. Articles are presented on the analysis and synthesis of electric power systems, the results of bionic developments in the USSR and the "artificial intellect."

The book will be useful to a broad class of specialists working in various areas of application of mathematical cybernetic methods.

INTRODUCTION

The modern phase of development of cybernetics is characterized by the transition to broad use of powerful data processing means in practice in all areas of science, the national economy and culture. The primary technical means which provide for the solution of the most complicated control problems in various areas of human activity is the computer with data transmission channels. The theoretical base of cybernetics research is applied mathematics, information theory, optimization theory, the methods of mathematical programming and a number of other important disciplines.

In world practice the computer has passed through the "special usage" phase in which at each given point in time the machine could be used by only one person, and it has gone into the collective-use phase in which large groups of people can access the computer system simultaneously and independently.

The application of effective methods of information transmission offers the possibility of remote use of computers and control machines and data input to them, from territorially removed sources. Computer networks have been built which, analogously to power networks, permit redistribution of the computer resources among the points in the system as they are needed. The difficulties which must be overcome in building such systems are well known. It must be emphasized, in addition, that efficient automated control systems can be built only on the basis of modern electronic engineering permitting not only computational transformations, but also remote, to a significant degree automated information input and output. In this case the automated control systems are provided with powerful software which offers the user the possibility of accessing the system in a convenient language close to natural language. The possibility is opening up for efficient solution of control problems on the basis not only of the mathematical methods of strict optimization, but also the heuristic methods of finding suboptimal solutions, including the dialog man-machine methods of finding the solutions. If the automated control system does not permit the solution of such problems, it turns out to be nothing but an expensive, poorly used calculator on which the simplest problems such as wage calculations are solved by a huge collective of highly qualified specialists that are in short supply.

This volume contains survey-type, problem-oriented articles on theoretical and technical cybernetics and some of the urgent areas of the application of the science of control processes and information processing connected with the creation of modern information complexes. These articles reflect the results of the work done by Soviet specialists in the mentioned areas in the last few years. In the articles the reader will find a discussion and evaluation of the results obtained in such research areas as queuing theory, relay theory and the theory of finite automata, the problematics of finite control, adaptive systems and vector optimization, information theory and its applications, and the mathematical theory of expectation. A separate article is included on the problems of the development of uniform computer structure, media, systems and networks. Applied cybernetics is represented by an article on the problems of the effective analysis and synthesis of large electric power systems.

One of the articles is on the analysis of the results and the lines of development of bionics as, in a defined sense, a "daughter" branch of cybernetics. Finally, the reader of the "Cybernetics in the Service of Communism" collection will find a detailed survey of Soviet research in the field of the so-called artificial intellect.

In a defined sense, this collection continues Vol 5 of the present continuing edition published by Energiya Press in 1967. However, whereas the mentioned volume encompassed all of the basic areas of cybernetics and its application as these areas had developed at the time of its preparation, the given book does not set that goal: during the time since 1967 the studies in the field of cybernetics have been so enriched, expanded and deepened that reflection of them into one book of a survey-type, problem-oriented nature has simply become impossible. This pertains, in particular, to technical cybernetics, which has now become an extraordinarily ramified area of science and technical practice enriched with new results. It is also possible to do the same thing about the mathematical methods of cybernetics.

All of this must be considered when reading the collection. Out of the mathematical problems of cybernetics, for example, the book contains an article on only one of the mathematical theories of the cybernetic area--queuing theory. The outline of achievements in technical cybernetics also does not claim to completeness. The problems of the application of the ideas and means of mathematics and cybernetics in the sciences of psychology, human behavior and training are not represented at all; biocybernetics and semiotics are missing; mathematical economics and the general methodological aspects of cybernetics have not been reflected. It is proposed that the next volume of the given continuing edition be devoted to these areas.

The article by B. V. Gnedenko "Mathematical Methods of Cybernetics. Queuing Theory" begins with a brief characteristic of the mathematical methods of cybernetics as a whole. Then follows a survey of the results and an analysis of the problems of queuing theory which is a natural, important part of cybernetics and finds numerous, varied applications. The sphere of the applied problems of the given theory has greatly expanded in recent years. The ideas and methods of queuing theory are being successfully used in engineering, production organization, various branches of the national economy, including transportation and the population service sphere, in scientific research, when planning, designing and utilizing computer and information control engineering.

The width and variety of practical problems in which the methods of queuing theory find application are giving rise to the first development of its software, the development of methods adequate to the newly occurring applied problems. In our country this theory is attracting ever-increasing attention on the part of the researchers in the most varied fields of interest, from engineering and technical workers at the enterprises and on the communications lines to mathematicians working in the purely abstract areas of their science. The article by B. V. Gnedenko indicates in what direction the given theory is developing in the work of the Soviet scientists -- researchers who are deriving the statements of new problems from practice and creating methods of investigation permitting the solution of the problems previously excluded from the mentioned theory.

The problems of information theory and its applications are discussed in an article by V. I. Siforov, R. L. Dobrushin, S. I. Samoylenko, B. S. Tsybakov, I. M. Boyarinov, S. I. Gel'fand, V. N. Koshelev and Yu. M. Shtar'kov. Its authors begin with the fact that the central problem of information theory is the problem of using the available technical means for information transmission, conversion and storage in a manner that is optimal from the point of view of speed, reliability and efficiency. In this article it is demonstrated that in recent years the center of gravity of information theory has shifted from the general theorems of existence of encoding methods with the necessary properties to the problems of developing specific coding techniques permitting actual data transmission with high reliability and sufficiently high speed. The significance of such abstract problems as the various approaches to the definition of the concept of information, from which the algorithmic approach developed in Soviet science is derived, is also analyzed.

In the investigated article there is a systematic discussion and analysis of the results obtained by Soviet specialists in information theory in the construction of codes with code distance linearly growing together with the length of the code; the study of minimum complexity of coding and decoding processes; the extension of the theory to the complex information transmission systems and computer networks. In six sections of this article the reader will find surveys pertaining to all principal areas of this rapidly developing mathematical and applied theory -- the problems of coding the sources of messages, information transmission over channels with noise, the problems of complexity and reliability of coding and decoding, algebraic and arithmetic codes. A special study is made of the coding problems in computer networks, which are highly important from the point of view of the development of cybernetics as a whole.

The set of problems of technical cybernetics is the subject of an article by A. G. Butkovskiy, M. A. Gavrilov, A. S. Krasnenker, A. S. Poznyak and Ya. Z. Tsypkin. From the broad class of technical cybernetic problems, this article takes up some knotty topics -- the theory of relays and finite automata, the theory of finite and adaptive systems, and the theory of systems that learn during the course of their operation. In the article it is noted that in recent years the applications of the theory of relay assemblies and finite automata have expanded in various engineering fields. Arising from the technical applications of boolean algebra and the model of a digital data processing device -- the finite automaton -- at the present time the given theory has become the basis for solving the most varied problems of technical cybernetics. It is used, in particular, for logical design of digital devices, for the construction of tests to check out the latter, and for decomposition of the systems, and so on. Fast development is taking place in such branches of theory as the investigation of indeterminate and probability automata, the study of the collective behavior of automata, theoretical problems pertaining to experiments with automata, and so on.

In the article by A. G. Butkovskiy, et al., the reader will find an investigation of some of the main problems of the theory of finite automata as they were solved in the works of Soviet scientists in recent years. The analogous investigations have also been performed for the "continuous" part of technical cybernetics (finite control, adaptive systems). In connection with the theory of finite automata, special attention is being given to the problem of the automation of the design of digital devices, inasmuch as they have the greatest influence on the development of this division of technical cybernetics. The automation of logical design, the authors of the article point out, implies significant reexamination of the methods of the classical theory of relays and finite automata, the purpose of which consists in the transition from operation by individual inputs, internal and output states of the automata to operation by sets of states. This leads to the problem of going from exact methods of finding optimal solutions to a directional search for solutions close to optimal. A consequence of these shifts is the expansion of the mathematical base of the theory which includes at the present time such divisions of modern mathematics as set theory, graph theory, coding theory, combinatory analysis, and so on.

Computer engineering is the most important means of realizing cybernetic goals, the basis for the large information processing and control systems. One of the prospective areas of its development is the development of uniform computer structures, media, systems and networks. The uniform structures and media, as is noted in the article by I. V. Prangishvili included in the collection, will permit achievement of high output capacity, reliability and economicalness of the computers. They are the basis for the previously developed fourth-generation computers. In the article by I. V. Prangishvili, which contains a survey of Soviet work in the given field there is a discussion of the prospects for the development of computer engineering and the role of research aimed at creating uniform programmable and adjustable microelectronic computer structures and means, the development of methods of analyzing and synthesizing them, and the construction of uniform, distributed computer systems.

In the article by G. K. Krug "Experimental Planning -- the Way to Improving the Efficiency of Basic and Applied Research" a survey is presented of the theoretical results and applied developments of Soviet scientists in the field of the theory of experimentation. In the three divisions of this article -- "Theoretical Research," "Application of Computers in the Solution of the Problems of Planning and Automation of Experimentation" and "Applied Research" -- it is convincingly demonstrated that the achievements of the mathematical theory of experimentation and the capabilities of a computer used jointly will permit formalization and optimization of the process of experimental research under the conditions of indeterminacy, minimization of the expenditures of time and means, and improvement of the reliability of the experimental data.

A survey of the state of the art with regard to the problems of analysis and synthesis of electric power systems investigated in the light of cybernetic concepts appears in the article by V. A. Venikov, R. G. Savchenko and V. A. Stroyev "Problem of Efficient Description, Analysis and Synthesis of Large Electric Power Systems. A Survey of the Modern State of the Art." In it the reader will find an important example of the application of the cybernetic systems approach to the simulation of the behavior of standard large systems such as electric power systems, and the analysis of the problems of controlling such systems under optimal operating conditions.

The modern problems of bionics are the subject of an article by V. M. Akhutin, V. S. Gurfinkel, V. I. Gusel'nikov, V. N. Yemel'yanov, A. B. Kogan, B. A. Levenko, I. B. Litinetskiy and G. N. Simkin. A discussion is presented in it of the results obtained in recent years by Soviet (and in part by foreign) scientists in the bionic studies of the receptors and analyzers, the simulation of neurons and neuron nets, the study of location, orientation, navigation and communication in the animal world. The work with respect to the creation of biotechnical systems and studies in the field of biomechanics are discussed in special sections. An outline of the historical development of bionics is also presented in the article which brings the reader to an understanding of the basic outlines of this

complex scientific area which is organically involved in cybernetic ideas.

In the concluding article of this collection by G. S. Pospelov and D. A. Pospelov, the "artificial intellect" research performed in our country is investigated. It must be noted that the work on this problem is among the areas of cybernetics which will undoubtedly be given ever-increasing attention. In this article it is correctly noted that although it is difficult to formulate a definition of the term "artificial intellect" and clearly define the boundaries of the area denoted by us at the present time, it is nevertheless possible to indicate the lines of research which undoubtedly belong to it. The authors of the article characterize these lines, giving attention, in particular, to the methods of solving the creative problems, the problems of automation of the proofs of theorems and the solution of game problems, the problematics of the "representation of knowledge" in the computer and automatic formulation of concepts, machine simulation of behavior, and problems connected with the building of robots

This book creates a broad, although not exhaustive picture of cybernetic research in our country. It makes it possible to get an idea about the trends in the development and the urgent problems of cybernetics in its theoretical, technical and applied areas. The areas of cybernetic research which have great scientific and national economic significance and must receive broad development in the near future include the following:

The development of methods of finding optimal and suboptimal solutions for problems of large dimensionality, the construction of man-machine control complexes for complex systems;

The development of methods, algorithms and the software for the automation of design in various areas;

The creation of industrial robots with "artificial intellect" elements;

The development and broad introduction of the remote data processing means based on computers with communication channels;

The study of the methods of constructing efficient computer networks for the distribution of computer capability and the creation of large collective-use computer systems based on them;

The search for methods of constructing algorithmic languages similar to natural language to use them in dialog man-machine systems;

The development of the methods of insuring high noiseproofness of information transmission and storage systems with simple software and hardware, and their application in the computer networks;

The development of methods of utilizing data processing systems to improve human work efficiency in various areas (scientific research work, planning and organizational administration, power engineering, transportation, industry, agriculture, public health, law, and so on).

The work in the indicated areas will promote improved efficiency in the work of the individual man and human collectives in many areas of their activity. Therefore no effort or means should be spared in their development. The advancements in these areas will have a significant influence on the overall scientific-technical and economic potential of the country. There is no doubt that the next few years will enrich cybernetics with new achievements -- achievements necessary for it to make its maximum contribution to the solution of the goals set for our national economy, science and culture by the resolutions of the 25th Congress of the Communist Party of the Soviet Union.

A. I. Berg

UNIFORM COMPUTER STRUCTURES, MEDIA, SYSTEMS AND NETWORKS

[Chapter by I. V. Prangishvili]

One of the prospective and actively developing areas in computer engineering is the development of uniform computer structures, means, systems and networks. The fourth-generation computers can be realized on the basis of uniform microelectronic structures and means permitting insurance of high output capacity, reliability, viability and low cost of computer circuits. As for uniform optoelectronic media, obviously they will serve as the basis for building fifth-generation computers.

The studies in the field of uniform computer structures, media, systems and networks are being performed in the following basic areas. The theory and technical means of high-output and reliable uniform computers, computer systems and networks, and distributed computer systems are being developed. Studies are being made of the principles of the organization of the computing process in the decentralized computer systems. The methods of controlling computer processes in uniform structures are being investigated. Methods of estimating the efficiency of uniform computers and systems operating in real time are being developed. Studies are being made of the problems of organizing parallel computations in uniform collective-use multiprocessor systems, the principles of the organization of uniform computer networks; the principles of the construction and the technical means of realizing uniform digital integrating structures and processes. Hybrid computing structures and means are being built. Studies are being made of the methods of synthesis, the problems of the reliability of monitoring uniform computer structures and systems. The element base and the technological support of uniform structures, means and systems are also a subject of development. Research is being conducted in the field of optoelectronic computer means and structures. The applications of uniform computing structures, means and systems are being studied.

New-Generation Computers

When building the hardware and the software for modern third-generation computers insufficient consideration was given to the requirements of their systems application. Obviously, the systems analysis of the use of computers will permit more complete determination of the actual requirements

of the users and the decision as to which new-generation computers should be built and with what characteristics.

There is still no defined or sufficiently expressed "ideology" of the structure of the computers of future generations. The most varied opinions of the problem of the development of hardware and software for such computers are frequently encountered. However, specialists do have a united opinion regarding a number of the indexes of computers of following generations. It is possible to propose that the fourth-generation computers will be the result of evolutionary and not revolutionary development of computer engineering. The development and introduction of such computers will take place gradually, and over the course of some period of time the new computers will exist along with the second and third generation computers. This arises from a number of causes, the main ones of which are the following.

The experience in using computers has been acquired on the basis of presently available hardware and software. This does not permit the users to make a complete evaluation of the volume of their requirements which can be satisfied as a result of new computer hardware. The users have become accustomed to computer systems based on second and third generation computers, and they are not ready psychologically or in practice for the advancement of substantiated, radically new requirements for the hardware and software of fourth-generation machines. Many of the computer users are inclined to require that the developers make simple improvements in the characteristics of the third-generation computers rather than radical alteration of the computers, inasmuch as such alterations would face them with the necessity for mastering the procedure of efficient systems utilization of the new machines. For basic reconstruction of computer engineering and the development of new, significantly higher requirements on the computers of future generations, it is necessary that the computer users overcome the psychological barrier, they recognize the capabilities of new computers and those of their requirements which can be satisfied as a result of the systems application of the fourth-generation computers.

Furthermore, the expenditures on computer hardware and software and the training of the users have at the present time reached such dimensions that the gradual development of computer engineering is advantageous for those who have access to the computers -- the creation of machines in which, along with the characteristics of the fourth-generation regimes, will retain all of the positive characteristics of the third-generation computers and also the software of the latter.

For improvement of computer engineering it is necessary more completely to consider the aspects of the software and the problems of improving the relation between the cost of the computer and output capacity. It is known, for example, that modern third-generation computers are little suited to executing the programs generated by the compilers; this, in particular, is connected with the fact that the developers of the computers

(including their software) usually do not know what instructions will be the most frequently executed by the latter. In modern computer systems no measures are taken to optimize the instruction system of the computer to obtain a program of minimum length. In addition, according to the available data 80% of all of the programs can be written using a total of only 20% of the machine instructions; therefore the system must be organized so that these 20% are executed by the hardware -- quickly and reliably -- and the remaining 80% of the machine instructions can be executed by microprogram and take more time.

In order to improve the efficiency of the computer systems by improving the output capacity of the software and hardware, it is necessary to systematically work on measuring and analyzing the loading of the hardware and the operation systems of the computer; this work will influence the methodology of the development of software and hardware, and it will promote more complete understanding of the properties of the software.

Up to now the paths of development of computer engineering have basically been determined by the builders and not the users of the machines. One of the causes preventing broad introduction of the third-generation computers is the unadaptability of the existing computers to the problems for which they were not designed, to the problems about which the designers of the machines have no idea when they designed them. At the present time it is becoming obvious that the computer designer must built a machine which, on the one hand, satisfies the existing demands of the users to the maximum, and on the other hand, will be suitable for the solution of problems which will appear in the next 10 years after the beginning of series production of the machine.

In the opinion of many specialists, at the present time there is a large difference between the number of recognized (already existing), proposed and active (potential) users of the computer. The modern third-generation machines can, according to their characteristics, satisfy 95% of the recognized users, 50% of the proposed users, and a total of only 10% of the effective users. Obviously in order that the effective users become recognized users it is necessary to know how to solve the basic mass of their problems on the computer. For this purpose computers of a new generation are needed -- machines with new capabilities and high technical-economic parameters.

Modern computers of classical architecture are oriented with respect to the principles of their construction and structural solutions toward the efficient solution of computing problems requiring the performance of the set of arithmetic operations, and they are little suited for solving noncomputational problems (game problems, recognition and classification problems, information retrieval problems, and so on). In this, they differ significantly from a man, who, on the contrary, solves noncomputational problems more efficiently than purely computational problems. Problems of the following important classes cannot be solved on modern computers of traditional architecture -- or they are solved with low efficiency.

(1) Nonformalized problems for which it is in practice impossible to put together precise mathematical models and, consequently, solution algorithms. These include certain pattern recognition problems (for example, the problems of recognizing moving or deforming targets) the recognition of speech and complex signals;

(2) In practice nonformalized problems, that is, problems for which it is theoretically possible to create mathematical models, but these models turn out to be so complex and awkward that the solution of the corresponding problems by modern computer engineering means is impossible or has low efficiency;

(3) Formalizable, but algorithmically unresolvable problems, that is, problems for which it is possible to create mathematical models but theoretically impossible to construct the algorithm of the solution. These include many game problems;

(4) Problems with complex solution algorithms, that is, algorithms the execution of which requires such awkward software that they are difficult to use in practice;

(5) Problems requiring the sorting of a large number of versions. Such problems usually occur during efforts to discover hidden laws in experimental research data, when constructing economic, biological, ecological and other models. The satisfactory solution of "sorting" problems on a computer of traditional architecture even with high speed turns out to be impossible.

For the solution of problems of all these types -- to the degree to which their machine solution is possible in general -- radical alteration of the architecture and the operating principles of the computers is necessary.

The fourth-generation computers obviously as before will remain basically a system which reduces the solution of the problems to a series of logical and arithmetic operations. Such a machine will realize only a process for which it is possible to construct a mathematical model and which can be described in advance by a series of standard mathematical and logical operations. However, much that is new will appear in the functioning of such machines. Thus, in the investigation of new machine architectures for the fourth-generation computers, at present a great deal of attention is being given to multiprocessor structures and adjustable uniform computer media designed for simultaneous processing and solution of problems permitting paralleling on the most different levels. The basis for the structural principles of such structures and means is the model of the human-computer collective performing a large number of logical and arithmetic operations in parallel.

In recent times it has become obvious that the parallel processing of information has a direct relation to highly varied applications of computers and that for a large number of classes of problems such processing has

obvious advantages. For example, many problems in engineering contain a large number of partial differential equations, and processing of them can take place in parallel. As another example we have the parallel processing of large files, which is possible as a result of the fact that the operations on the files in the majority turn out to be independent of the order of their execution. Many in practice significant problems belong to a class naturally accessible to solution by using "parallel" algorithms; other problems require complex paralleling algorithms on different levels.

Thus, the problem of programming several parts of the same problems solved in parallel or several problems solved in parallel arises. The complexity of this problem -- its statement is meaningful in the case of multiprocessor computers -- consists in the fact that the a priori estimate of the execution time of the individual sections of the program is in practice impossible; therefore during the problem solving process it is necessary to provide for automatic redistribution and optimization of the load of all the parts (processors) of the system operating simultaneously. This problem is complicated as the number of processors and programs operating simultaneously increases. It is true that the problem is facilitated if individual processors are narrowly specialized, but in this case incompleteness of the use of the equipment and some tying to the nature of the solved problems and, consequently, loss of universality of the computer, are unavoidable. Accordingly, the possibilities of uniform, adjustable structures are of great interest in which the organization of multiprocessor computers will not require complex systems for automatic redistribution of the load of the processor elements operating in parallel.

It is possible to assume that the fourth-generation multiprocessor computers will be characterized both by structures with hierarchical subordination of the processors (where one processor has several others at its disposal) and by single-level structures, with equivalent processors. For reorganization of the hierarchy and alteration of the priority of the subordinate processors in the system provision is made with the possibility of raising and lowering the position and the qualification of the various processors.

The associative principle of information retrieval and processing must find broad application of the fourth-generation machines. The computers will contain an associate ready-access memory and processors executed from large integrated circuits. It is possible to propose that an associative memory of large information capacity will also be built on magnetic discs with a head for each track and an electronic retrieval mechanism. Then the associative retrieval time will be compatible with the disc access time. The appearance of a large-capacity associative memory will basically change the entire problem of systems designed. Thus, for example, when developing systems it is not necessary to create long, ordered sequences of lots of information and to decide how to work them into the files. It will not be necessary to be concerned with indexing. Any data coming into the system can be placed in any free location in memory without reordering the information and it will be possible to access the data independently of where it is placed.

In contrast to the third-generation computer the operation system of the fourth-generation computers will be located not only in the program parts of the systems, but also in the hardware parts of the systems. It is possible to expect hardware execution of a significant part of the operations system and translators, which will lead to increased output capacity and reliability of the computer.

Finally, in machines of the subsequent generation the capabilities of human communication with the machines by ordinary voice control will be expanded significantly; means will be created for efficient implementation of the dialog mode.

At the present time, using third-generation computers in control problems, the real, deeply "parallel" situation frequently is converted to a calculation problem, representing it in the form of a mathematical model, and then the stated mathematical problem is solved on computers on which it is possible to execute the "series" algorithms efficiently. In order to provide for the solution of problems in real time under such conditions (which is necessary, for example, for automatic control of real processes and targets) the speed of the computer elements and modules will be increased by all possible means. In a number of cases, however, this will lead to negative results or even to deadend solutions.

In the fifth-generation computers obviously provision will be made for more radical changes in the architecture, in the operating principles and in the methods of organizing the computation process than in the fourth-generation machines. This will be connected, on the one hand, with the development of the technology of cheap, reliable and effective optoelectronic and holographic processors, memories and input-output devices, and on the other hand, with the inclusion of large-format or dimensionality problems -- the problems which in practice cannot be solved on third and fourth-generation computers — in the problems solved by the fifth-generation computers.

In all probability the fifth-generation machine will have the attributes of the programless learning computer. The essence of the program training consists in providing for a comparison of the actual situation to a standard situation as a result of internal rearrangement of the structure of the computer and generating an output reaction corresponding to the input situation.

Uniform Computer Structures and Media

Uniform computer structures and media are one of the prospective means of building new-generation computers. The possibility of program adjustment of uniform media permits the realization of a digital automaton in each specific case, the logical structure of which corresponds to the highest degree to the structure of the algorithm for solving the specific problem. The application of uniform adjustable structures and new logical organization when creating digital devices should make the machines of future

generations functionally flexible, highly productive and viable and insure high standardization and low cost of them [1, 2].

Uniform Multimicroprocessor Computer. The principles of the construction of high-output and viable control computer systems and methods of organizing the computation and control processes have been developed on the basis of uniform programmable microelectronic structures [3]. The basis for the "ideology" of the construction of the uniform computer systems is the principle of rearrangement of their resolving fields -- processors -- during the course of the computations in accordance with the requirements of the computation process; the rearrangement is realized as a result of broad utilization of uniform, rearrangeable microprocessor structures as the basic means of hardware execution of the processors and the control modules of the system.

The uniform resolving field is a set of like microprocessors operating in parallel. The number and the configuration of the simultaneously operating microprocessors are determined by the requirements of the problems solved and the size of the resolving field. As a result of the use of uniform resolving fields, it will become possible to form the required number of microprocessors and join them into the configuration conditioned by the problem during the course of solving the problems; parallel execution of different operations on different scalar and vector variables will become possible; conveyor organization of the computation and control; broad paralleling of the computation and control processes (with respect to branches and inside branches). As a result of the high level of the instructions and their hardware execution, high output capacity will also be insured -- output capacity which will be an order higher than that of traditional computers. Therefore in a number of cases the same output capacity will be insured by using integrated circuits that operate an order more slowly and therefore which are cheaper. The adjustability of the resolving field in accordance with the problems of the given specific application will permit the introduction of new consolidated operators, new instructions.

The use of uniform programmable structures and associative memories for hardware execution of part of the software will permit the introduction of changes and additions to the operation system without changes in the system hardware. The operation system can be rearranged depending on the configuration and classes of problems solved.

Associative Processor. In recent years the principles of the construction of uniform associative parallel processors based on uniform specialized microelectronic structures have been developed [4]. The associative parallel processor is designed for group processing of data files; it performs identical logical and arithmetic operations simultaneously on a set of pairs of numbers. This is important for problems where group processing of the data files is required. Such problems are encountered in many fields of science, engineering and economics; they include the

problems of classification, identification and recognition of signals and patterns, technical and medical diagnostics, statistical data processing, and so on. The associative processor insures two or three orders higher output capacity for the computer than that of ordinary computers. The effective speed of uniform associative parallel processors reduced to a pair of numbers and realized from ordinary integrated circuits of the "metal-oxide-semiconductor"[MOS] structure approaches 10^9 operations/sec when solving digital filtration problems [4].

Uniform Microcomputer. On the basis of uniform, freely programmable structures, a uniform microcomputer has been developed which is characterized by limited memory size, small word length, small size, simplified software and interface and, as a consequence, low cost [5, 6]. The microcomputer obviously will become the most mass produced and cheapest algorithmically universal computer with microprogram control for local monitoring and control of individual technological operations or groups of operations as part of the automated technological process control systems; such machines will be used as the computers built into instruments, operations and technological equipment, as data recorders, as "intelligent terminals," and so on.

The equipment of the uniform microcomputer will include the following: uniform resolving field performing logical and arithmetic operations and having input-output information, adjusting and control buses; ready-access memory of the cassette type executed from shift registers; permanent memory for storing instructions (operators) containing codes for adjusting the uniform resolving field; permanent (semipermanent) memory for program storage; a control jet including a module for adjusting the uniform resolving field and, finally, the input-output and monitoring device.

The possibility of adjusting the resolving field in each computation cycle to the required processor configuration gives rise to a high level of machine language for the uniform microcomputer. If primary characteristic is that the elementary instructions (operators of the uniform computer -- the instructions of the type of multiplication, extracting a root, vector addition, and so on -- correspond with respect to content to the microprograms of ordinary microcomputers. This "consolidated-operator" system of instructions permits simplification of programming and reduction of the program memory of the microcomputer. The hardware execution of the operators in a uniform resolving field and the possibility of organizing several parallel flows of computation will increase the output capacity of the computer. The simplicity of building up the resolving field and the cassette structure of the ready-access memory will permit the configuration of the microcomputer to be altered, creating various versions of it.

The structural principles of the high-output uniform computer for group data processing have been developed on the basis of the rearrangeable uniform associative structures [7,8]. Such a computer will provide high

efficiency of the solution of not only computational problems, but also information retrieval problems. The high technical-economic indexes of such a computer must be achieved as a result of using the following: uniform associative resolving field in which search, sorting, row by bow two and three-dimensional processing of the operands are easily realized; distributed local microprogram control permitting sharp reduction of the number of references to the ready-access memory and a decrease in the program size by an order; and the structural programming of the problems insuring a reduction in the number of instructions in the programs. The high viability, reliability and noiseproofness of the computer are achieved as a result of the capacity of the computer structure to be rearranged and the use of noise-proof coding.

Such a high-output computer together with an ordinary digital computer will form a computing system in which the digital computer will serve as the dispatcher and the control unit for the peripheral devices. Such a system is capable of processing information in real time; it is effective in the solution of matrix problems, the problems of spectral processing of signals, the solution of systems of partial differential equations, pattern recognition and pattern processing problems, economic problems, and information retrieval problems.

The computer with parallel structure for group data processing consists of some number of identical microprocessor elements which simultaneously execute the same instructions given by common microprogram control. The microprocessor elements are connected to each other by regular couplings providing for interaction with the nearest neighbors; as a result of the address couplings each element is coupled to the other. Each microprocessor element includes a computing module and a correlation device providing for adjustment of the regular and address couplings between the computer modules. The regular coupling channel is used for parallel sending of data simultaneously between all the computer modules. During the exchange of data between the microprocessor elements over the address channel, the sent data is accompanied by names. The microprocessor elements, the contents of the address register of which coincide with the name of the data coming into the address channel, generate a signal permitting reception of the data in the corresponding register of these microprocessor elements. Each computer module will modify or block the execution of individual arithmetic or logical operations from a given set, realizing only part of the exchange operations.

Structural Models. Radio Pulse Computers. The programming of problems on such computers is accomplished by the structural method. The program formed in the control unit for the given class of problems gives the operator for conversion of the data coming to the input of the computer module and also the nature of the regular and address couplings between the computers in accordance with the topology of the solved problem. The programming of the solution of the problems on the computer will therefore become analogous to the structural programming used in analog computers.

The use of uniform media as rearrangeable structural models is highly efficient. As a result of the variable structure, the uniform medium will permit investigation of the models of possible versions of the devices and will make it possible to find a more efficient version without large expenditures of means and time. The use of uniform means as a simulator is prospective for PERT problems. The application of such means will permit the solution of the problems of optimizing PERT charts in a clear, easily understood form. The search for the shortest path in this case is realized in the time of propagation of the excitation waves between the corresponding modes of the multidimensional graph depicted in the medium [2].

Great possibilities are included in the application of the uniform media to construct radio pulse computers in the microwave band. The uniform radio pulse computers can insure a speed of 10^9 operations/sec without difficulty [9].

The radio pulse uniform computer media are an efficient means of realizing digital devices for processing radio signals. At the present time a model of a radio pulse medium has been developed and investigated. The cells of the medium are made for parameters, the information carrier in which is the superhigh frequency signal phase. A cell of the medium performs the logical "AND" (conjunction), "OR" (disjunction), "AND-NOT" (Scheffer stroke), "OR-NOT" (Nico stroke) functions of two variables and the majorital function. In addition, it realizes the functions of coupling and uncoupling the direct or inverse data transmission channels [9].

The functional part of the cell of the medium is executed in the form of one hybrid-film integrated circuit using film inductance coils in the oscillatory systems of the parametrons. The adjustable part of the cell contains an optoelectronic input device and a logical circuit for selecting the excitation phase of the parametrons; it is constructed on the basis of photodiodes.

The experimental studies of the microelectronic markup of the radio pulse medium confirm the practical possibility of processing radio signals directly on the carrier frequency in real time in digital form which can essentially change the structure of the modern radio technical complexes, simplify and decrease the cost of their construction. The possibility of direct processing of the signals on the carrier frequency will permit the use of radio pulse uniform media in radioholography, in devices for detection and reception of phase-pulse signals and signals with digital frequency modulation, and so on.

Digital Integrating Structures. One of the prospective paths permitting most complete consideration of the requirements of output capacity, technological nature, reliability, economicalness of the computer structures is the development of uniform digital integrating structures [10].

The uniform digital integrating structure consists of like processors called resolving modules (integrators) and like switching elements forming the electronic commutation system; by using this system, the resolving modules are adjusted to execute various functions, and the processes are coupled to each other in accordance with the solved problem.

In order to increase the efficiency of the use of uniform integrating structures, software has been developed the primary purpose of which is automation of the process of the preparation and solution of a broad class of problems. It includes the structure and program automation system, problem-oriented language, operation system and library of standard programs with special functions. The software permits automatic transition from the initial system of differential equations to the system of Shannon equations, and from it to the commutation program for the resolving module and calculation of the initial data of the equations. The effort to exclude the universal computer from the system toward which with the ordinary approach the entire software system is oriented, leads to the necessity for hardware execution of the software in the uniform digital integrating structure [11].

Along with the development of the processors of uniform digital integrating structure, work is being done to create commutation elements and systems providing for automatic coupling of processors in the structure. The deeper studies of the problems arising when constructing channels for transmission of digital data in uniform structures has led to the creation of uniform automated commutation registers for them. The development of such structures will permit not only the solution of the problem of automated construction of the communications channels which vary in time in accordance with the variation of the external effect, but also advancement in the very important problem of synthesizing automata with programmable structure.

For expansion of the functional possibilities of the uniform digital integrating structures and improvement of their speed, integro-arithmetic structures have been developed which use the idea of matching the calculation of continuous variables on the basis of numerical integration of the systems of generating equations with the solution of arithmetic and logical problems by the methods of approximate calculations.

At the present time a large complex of experimental design operations have been carried out to create operating models and examples of uniform digital integrating and integro-arithmetic structures. The further expansion and deepening of the studies in the field of uniform computing structures has been aimed, in particular, at the development of the theory of automata with programmable structure, including automated register commutation systems, and the theory of uniform neuron-like computing structures. In addition, the plan calls for the creation and introduction of the desk model computer into the national economy and also the single-crystal processor of the uniform computing structure, on the basis of which a new-generation uniform computer structure can be created [11].

Nonalgorithmic Bit Structures. The most important goal of the modern theory and technology of computer engineering is the development of technical means, the speed of which will not depend on the complexity of the solved problem (as occurs in the analog computers). High accuracy of the processing of the information characteristic of digital computers would be maintained. One of the possible paths of the solution of this problem is the transition to hybrid type structures organically combining the digital form of representation of the machine variables with the nonalgorithmic method of operation. Such computer structures were called nonalgorithmic bitstructures [12]. If such structures are implemented on the basis of the element base of digital machines, they unconditionally are called nonalgorithmic digital structures, and if on the element base of the analog machines, then bit analog.

At the present time the structural principles have been developed for the nonalgorithmic bit structures, and methods of solving standard mathematical problems on them have been proposed. Expedient areas of application of such structures and the possibilities of the practical realization of nonalgorithmic machines designed for defined classes of problems requiring solution in real time or lead time are defined.

Adaptive Functional Structures. The modern phase of development of computer engineering is characterized by the transition to the construction of computers based on large (5000 to 10000 components in a crystal) and superlarge (hundreds of thousands of components in a crystal) integrated circuits. However, with an increase in level of integration, the percentage output of good circuits is reduced sharply. This inhibits the wide application of integrated circuits with high integration level. Accordingly, in order to increase the profitableness of the production and insure the prospectiveness of the further increase in integration level it is necessary to develop principles for the construction of computers which will insure the possibility of effective use of the circuits having failed components. In this respect, the creation of adaptive functional modules -- modules in which the adjustment to the execution of the given function is made using an adaptation procedure as a result of which the failed components are automatically bypassed or blocked -- is prospective. The adaptive adjustment excludes the necessity for diagnostic control measurements, for in this case detection of the failed components is not required. The adaptive methods also open up the path to programless solution of problems.

In recent years a study has been made of the adaptive uniform structures constructed from pulse threshold elements with refractoriness. In the presence of a variable threshold such structures can be adaptively adjusted to the execution of the required functions. It is demonstrated that such structures have automaton completeness. They can be executed by modern microelectronic means. When constructing adaptive uniform structures, the processes of self-reproduction and self-assembly of the elements can be used [13].

Problems of Logical Synthesis of Automata and Their Reliability. The theoretical studies in the field of uniform structures and media have led to development of methods of analysis and synthesis of uniform structures, the methods of realizing them on the basis of the integrated circuits and also the methods of organizing the process of solving problems of different classes. Formalized methods of synthesizing automata in uniform structures have been developed and investigated.

As is known, any automaton can be given using structural or algorithmic description. For structural description the functional diagram of the automaton is given in the form of a logical circuit or system of boolean functions. For algorithmic description of the automaton in one of the initial languages, an algorithm is presented for its functioning. Depending on what is realized -- the functional diagram of the automaton or its operating algorithm — two groups of procedures for logical synthesis of automata in a uniform medium are isolated. In the first synthesis procedure first the classical synthesis of the functional diagram of the automaton is carried out on the basis of the elements of uniform medium considering some of its peculiarities; then by using formalized methods, the "imbedding" of the functional diagram obtained in the uniform medium is realized. With the second procedure formalized placement of the algorithm for the functioning of the automaton in the uniform medium is realized so that the medium will simulate its individual states in turn [14].

The uniform media, as a result of the principles of variability and uniformity inherent in them, permit significant increase in the physical reliability of the elements, simplification of the process of monitoring and diagnosing the circuits, an increase in the functional reliability of the devices which are executed from them. In order to increase the reliability and viability, highly effective methods of monitoring and diagnosing the uniform media have been developed. The uniformity and variability of the structure permit the application of the same algorithm immediately to a large number of elements, which leads to a noticeable reduction in the failed element search and control time. The uniformity of the structure combined with the possibility of programmed rearrangement of it will permit simplification of the procedure used to find the failed elements by more than an order. At the present time studies are being made of various methods of improving the reliability of the structures executed on the basis of uniform structures. Here, local and global methods of rearranging the structures to exclude the failed elements from the executed circuit have been developed [2].

Summing up the results, it is possible to state that in the work of Soviet and foreign scientists at the present time the scientific and technical principles of the construction of programmable microelectronic uniform structures and digital devices based on them have been laid down. The structural principles and the methods of execution of computer circuitry based on uniform structures have been developed, and the methods

of organizing computational processes in them have been investigated. Several procedures have been developed for the physical execution of the elements of uniform structures on the basis of the integrated MOS technology. At the present time studies are being made of the possibility of the execution of uniform media with parallel input of the adjustment information by means of microoptoelectronics [15].

In spite of the significant progress in the creation of the fundamentals of the theory and engineering of uniform structures, many of the scientific problems connected with it still await solution. Among them it is necessary to note the problems of the development of a convenient language for describing the functioning of the uniform structure and its elements; the creation of methods of through synthesis of the devices based on uniform structures, satisfying the given criteria; the construction of algorithmic languages oriented to give algorithms to solve problems in uniform structures; the development of effective methods of structural simulation of the complex problems in uniform structures and the methods of their effective solution; determination of class of problems solved optimally on the uniform structures; the creation of effective optoelectronic uniform media and methods of parallel adjustment of their structure.

Uniform Computer Systems and Networks

For a number of the complex computer systems, the placement of the computers or the centers at significant distances from each other while maintaining connectedness of their elements is characteristic. For such systems there are two types of problems: local problems, that is, the problems which are solved by individual elements of the system, and global problems solved by the system as a whole. For the solution of both local and global problems it is expedient to use uniform distributed computers, the basis for the construction of which is the distributed model of the computer collective [10].

The distributed computer system using the model of the collective of computers is based on the principles of parallel execution of the operation, variability of the logical structure and the structural uniformity. The uniform computer networks are a special case of uniform distributed computer systems.

At the present time the construction of the distributed computer system with relatively simple structure and output capacity approaching the product of the number of the machines in the system times the productivity of an individual machine is an important scientific and technical problem. This distributed computer system must behave as one large computer system with total output capacity and total basic and external memory size. For achievement of this goal it is proposed that the conveyor method of information processing be used considering the possibility of the joint operation of the input-output channel and the machine [16].

Uniform Distributed Microprocessor Control Computer Systems. The modern state of the art and the prospects for the development of uniform distributed computer systems will permit the statement and solution of the problems of the development of distributed control systems.

The distributed controlling computer systems can be provisionally broken down into two types. The first type includes the functionally or territorially distributed systems where in order to increase the viability and economicalness of the control system the circuits making it up (the microcomputer, the microprocessor systems, minicomputer, and so on) are territorially (functionally) distributed with respect to the entire object of control.

The occurrence of such systems is no accident. With the appearance and broad assimilation in recent years of microprocessors, microcomputers and other microprocessor systems, a trend is being observed in the control strategy toward the transition from strongly centralized control systems to distributed systems in which the small microprocessor modules, in accordance with the functional principle, are located near the objects of control. Such multimicromachine systems provide for increased technical-economic indexes as a result of reducing the connecting lines to the objects of control and on the basis of the fact that a failure in the functioning of any microcomputer causes a failure not of the entire system but only a small part of it.

The second type of distributed control computer systems includes the territorially concentrated multimachine or multiprocessor control computer systems in which in order to increase the output capacity the solved problem is distributed among several computers or processors. The output capacity of this computer system must approach the product of a number of machines (processors) in the system times the output capacity of the individual machine. This computer system behaves as one large computing machine with total output capacity and total basic and external memory size.

The uniform multimachine (multiprocessor) control computer systems can have centralized, decentralized and mixed control.

The uniform multimachine (multiprocessor) control computer system with centralized control is characterized by hierarchical subordination of machines (processors). This system will contain a specially segregated control machine (processor) which realizes the control in which all the machines (processors) of the system are combined into a unit whole. If the system provides for the possibility of raising or lowering the position and the qualification of the various processors (machines), then the reorganization of the hierarchy and variation of the priorities of the subordinate machines (processors) are possible.

In the uniform control computer system with centralized control and matrix of electronic computers (processors) the central control machine controls

the information load of the like computers (see Fig 1). Each computer exchanges data files with the input-output units and external memories through the central control computer. If in a matrix of n computers (Fig 1) one and the same instruction is executed on 2n different numbers simultaneously, the effective output capacity of the uniform computer system increases by n times. A standard representative of the uniform computer system with centralized control is the well known ILLIAC IV system.

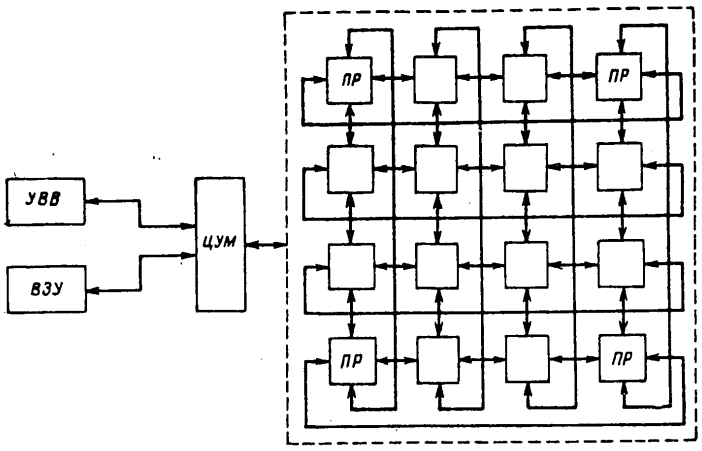

Figure 1. Structure of a uniform matrix computer system with centralized control.
УВВ -- input-output unit; *ВЗУ* -- external memory;
ЦУМ -- central control computer; *ПР* -- processor

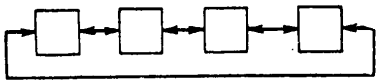

Figure 2. Uniform ring computer system with decentralized control

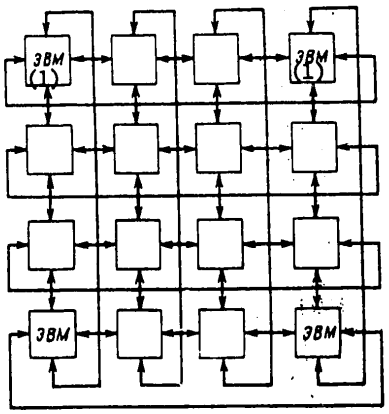

Figure 3. Uniform toroidal (matrix) computer system with decentralized control
Key:
1. computer

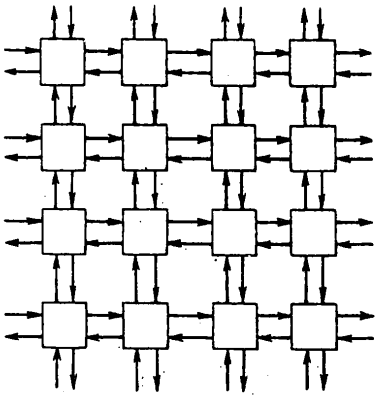

Figure 4. Structural diagram of a uniform multimicroprocessor computer POPSY with decentralized control

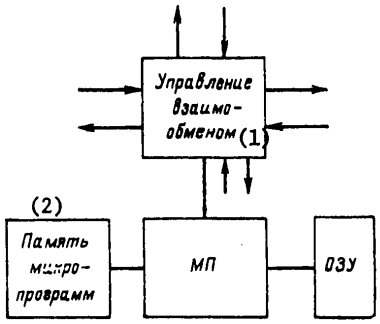

Figure 5. Structural diagram of one module (microcomputer) of the POPSY computer system
-- microprocessor; -- ready-access memory
Key:
1. mutual exchange control
2. microprogram memory

The computer system with decentralized control contains equivalent machines (processors) and excludes their hierarchical cosubordination. Such a system has no unique, clearly fixed machine (processor) which controls the solution of the problems in the system. Each machine entering into the system with decentralized control is independent in its actions, but its overall organization and the control programs in each of the machines are such that the system of machines can provide for the execution of a united program.

In the computer systems with decentralized control all of the operations connected with information input and output are realized autonomously by all of the computers entering into it. The package processing mode is realized for each computer independently of the others. When solving the problem of increasing the output capacity of such control computer systems the information exchange with the "external environment" remains the worst bottleneck.

The block diagram of the simplest uniform computer system of the ring type with decentralized control is presented in Fig 2. From the figure it is obvious that in such a system all of its computers are connected in a ring. Fig 3 shows the block diagram of a more complex toroidal or matrix uniform computer system with decentralized control.

The standard representative of the uniform computer system with decentralized control is the POPSY system created in the United States [17]. The developers of this system pursued two goals: simplification of its software and a reduction of the requirements on programming quality. The structure of the multimicromachine computer system POPSY made up of 16 modules (microcomputers) is represented by the block diagram depicted in Fig 4, and the structure of one module is presented in Fig 5. As is obvious from the figure, the structure of the given system is a two-dimensional array of micromodules (microcomputers). Each module is executed from metal-oxide-semiconductor crystals (MOS-crystals) and is made up of a microprocessor, the microprogram memory, the ready-access memory and the control crystal which permits programming of the couplings between the modules in the system.

The information command exchange in each microprocessor module with four neighbors with respect to the array is realized through the intermodular coupling control crystal. In the POPSY system it is possible to switch the shift and carry circuits of the adders of the individual micromodules, which will permit operation with long numbers and with rows of data. The possibility of rearrangement of the system structure permits program simulation (emulation) of the architecture of "conveyor" computers. As follows from what has been stated above, the foundation of the elemental base of the module of the given system is the integrated circuit with programmable functions or the microprocessor and the integrated control circuit programming (switching) the connections between adjacent models of the system.

An interesting characteristic of POPSY system is the fact that its builders rejected the multiprogramming and time sharing modes (a large part of the operation system in ordinary series computers is busy with the servicing of these processing); as proposed, the system will operate in a united multiuse mode. Each problem or each user has at his disposal one or several modules of the system. It is true that the problem can turn out to be so complex that its solution will occupy the entire system as a whole.

The system designed to process radar data [17] can serve as an example of a uniform multiprocessor computer system with mixed control. The system contains 64 operating and 4 reserve micromodules (microcomputers) of the type presented in Fig 5 with average characteristics. Each micromodule has a coupling to the other three. The data accounting and transmission are realized in parallel. The input-output is realized through a common channel. The control is two-level; one level is formed by the general instructions issued by the central control computer, and the other level, by the instructions generated inside each module. The output capacity of such systems is proportional to the number of micromodules. In order to increase the reliability of the system, four reserve micromodules are used, and the communications network is closed in a ring.

It appears that the properties of the microprocessor large integrated circuits with programmable functions of the modules and intermodular couplings can be fully used when building the data processing systems of fourth-generation computers based on the principles of parallel processing, the programmable structure and the structural uniformity.

Estimation of the Efficiency of the Computer Systems. A large number of parameters and facts characterizing the methods of organizing the computer process in uniform computer systems make the problem of estimating their efficiency highly multidimensional. In addition, depending on the goals which face the computer system, various criteria can be used to estimate the effectiveness. These facts complicate the statement of the problem of analyzing the efficiency of computer systems and methods of organizing parallel calculations in general form. Accordingly, partial estimates of the efficiency of the computer systems are made. The studies in this area have made it possible to perform design calculations to estimate the efficiency of the structure of the multiprocessor and multicomputer computing systems by the criterion of variation of output capacity of the computer system by comparison with the total output capacity of the component machines [18]. Here the efficiency estimate reduced to the problem of analyzing the efficiency of the interaction in the parallel computer processes considering the expenditures on the organization of the calculations, information exchange and the losses when using the common memory.

The complex problems, the effective solution of which requires paralleling can be classified by a number of attributes. The most significant among them is the admissible depth (degree) of paralleling and connectedness of the parallel-executed branches of the computing process. These qualities

determine the effectiveness of the application of certain technical programming means or others for the organization of parallel computer processes. The presence of a common field in the ready-access memory for several processors makes it possible to have an efficient processing procedure with any organization of parallel computations, including with strong connectedness of the individual processes, for there is no necessity to shift the data during information exchange, and there is a possibility of using common information and program files. However, the admissible number of processors in such systems is significantly limited, which excludes deep paralleling [19]. The introduction of the direct exchange channel between the machine and the peripheral devices will permit an increase in the number of processors using the common memory field, which means the admissible degree of paralleling. However, the total effectiveness of such a system is achieved only with sufficiently little interaction of the parallel-executed program branches.

At the present time the procedure for determining the number of machines (processors) in the uniform computer system based on utilizing the model not taking into account the productivity losses caused by references to memory has been well developed. However, in real systems significant losses of productivity occur as a result of references to memory, especially the external memory. In order to eliminate this deficiency, a model of the computer system was subjected to investigation in which the joint functioning of several computers having a defined volume of ready-access and external memory is taken into account. It is demonstrated that the output capacity of such a system is determined by the number of exchanges between the computer and the external memory and between the computer and the computer. A procedure has been developed which permits efficient selection of the volume of the ready-access memory and the average access time to the external memory with a fixed number of computers and also the choice of other system characteristics [20].

A basic characteristic of the uniform computer system is the presence of intensive interactions between the machines -- data exchange, exchange of control signals, requests and responses. The isolation of the centralized unit for controlling interactions leads to disturbance of the functional uniformity, a reduction in viability and efficiency of the system. The decentralization of control leads to specific methods of resolving conflicts between the different interacting subsystems on the basis of local (in space or time) information and the corresponding losses [21]. Accordingly, three different decentralized interaction disciplines were investigated: priority, circular and mixed. The priority discipline presupposes that all the machines are ordered with respect to priority, and it is known at each time which machines interact and how many communications channels are free. The machines receive channels by priority if the required partners do not interact. The circular discipline presupposes that each machine operates in the multiprogram mode and has a buffer to accumulate an internal queue of requests. The requests are serviced by the machine after the transfer of system control to it. After servicing its requests, the machine

transfers control to the next machine. The circular discipline, in contrast to the priority, does not cause algorithmic conflicts and, consequently, losses. With a mixed discipline the control is transferred each time to the machine which has accumulated more requests in its queue.

The development of uniform computer systems made up of many computers and microcomputers is one of the new quickly developing areas of computer engineering. The construction of highly efficient and viable uniform systems from many computers and microcomputers is expanding as an area of application of computer engineering and in many cases is excluding the necessity for using universal medium and high power computers.

The analysis of the computer systems known from the literature indicates that they have a number of disadvantages. These include the fact that the systems are built on the principles of parallelness of execution of logical and arithmetic operations -- as a result of paralleling on the operations level, large losses of reserves occur for synchronizing the machines and transmission of information between them, and this complicates the organization of an efficient parallel computation process; on the basis of the presence of a common control unit, the reliability and viability of such systems are low. In order to eliminate the indicated deficiencies, a method was proposed for constructing the computer systems made up of many computers which is based on the principle of parallelness of operation of the machines when solving complex problems in the multiprogramming modes, on the one hand, and the principle of programmability and regularity of the structure of the communication network between the machines, on the other hand. It is demonstrated that with relatively little additional hardware and software expenditures it is possible to build a uniform computer system with a variable number of machines, with high output capacity and viability; the industrial designs of the MINIMAX [22] and SUMMA [23] computer systems have been developed.

The active development of research in the field of uniform adjustable microelectronic structures and media is having a stronger and stronger influence on microelectronics and fourth-generation computer engineering. The further progress in this area must lead to the creation of qualitatively new multimicroprocessor computer systems of subsequent generations.

The foundation of the element base of the high-output uniform multimicroprocessor computer systems is the large integrated circuit with programmable (adjustable) functions or the microprocessor and integrated control circuit permitting programming of the couplings between the microprocessor modules. The positive characteristics of the large microprocessor integrated circuits will be used to the highest degree in the control computer systems of the fourth and fifth generation based on the principles of parallel processing, programmability of structure and structural uniformity.

The creators of the prospective multimicroprocessor computer system are pursuing several goals, among which it is necessary to note the increase

in output capacity and viability of the systems, simplification of the software and a reduction of the requirements on programming quality. With the appearance and assimilation of microprocessor systems in the control equipment, a trend is observed toward the transition from highly centralized control systems to distributed control systems, in which the small microprocessor modules are located directly at the objects of control, which improves the technical-economic indexes of the systems. However, it must be noted that in spite of significant progress in the creation of the theory and the engineering of uniform adjustable computer structure, media and systems, many scientific and engineering problems in this area await solution. Among them, above all, it is necessary to note the problems of the development of effective methods of structural simulation and the solution of complex problems in the uniform structures and systems, determination of the class of problems efficiently solved on uniform computer structures and the creation of effective means of parallel adjustment of the medium and new methods of improving reliability.

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