JPRS L/9692

27 April 1981

USSR Report

CYBERNETICS, COMPUTERS AND AUTOMATION TECHNOLOGY

(FOUO 12/81)

FBIS FOREIGN BROADCAST INFORMATION SERVICE

FOR OFFICIAL USE ONLY

APPROVED FOR RELEASE: 2007/02/08: CIA-RDP82-00850R000300100055-7

NOTE

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

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

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

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

JPRS L/9692

27 April 1981

USSR REPORT

CYBERNETICS, COMPUTERS AND AUTOMATION TECHNOLOGY

(FOUO 12/81)

CONTENTS

HARDWARE

PROJECTED DEVELOPMENT OF COMPUTER TECHNOLOGY

Kiev NAUKOVEDENIYE I INFORMATIKA in Russian No 20, 1979 pp 82-88 manuscript received 19 May 78

[Article by B. Ador'yan, Hungarian People's Republic Institute of Coordination of Computer Technology, Budapest]

[Excerpts] For the future it is possible to predict the formation of three major trends: 1) strengthening of the importance of dialog systems, in particular, on account of package processing systems; 2) an increase in the proportion of independent "small" systems and "built-in" small computers (microprocessors); 3) an increase in decentralization and together with it an increase in the role of systems with distributed parameters, or, in other words, of multiple systems.

Part of the principles enumerated will be implemented in the next five to 10 years with the further development of IBM systems and concomitantly with it of YeS [unified series] computers, as well as in designs of so-called small computers.

In the future, in the following 10 to 20 years, simultaneously with an increase in the number and requirements of areas of application, and also depending on the further development of technology and improvement of the efficiency and reliability index, it is expected that the beginning of a polarized process is probable with considerable improvement of data transmission capabilities, instead of the further development of a family of computers in unmodified forms (e.g., the IBM 360, IBM 370, etc., in the West and the "Ryad" and "Ryad-2" YeS computers in the socialist camp), which play a dominating role at the present time and which constitute the more important share of the quantity and total cost of computers. For the purpose of independent applications small computers and systems are being used, consisting of basic elements manufactured with a relatively high degree of standardization and having the capacity of programmability and a diversified structure for certain special cases of application.

Concomitantly with an improvement in communication methods, including the improvement of reliability, and with a reduction in their cost in many areas of application, the necessity will be increased for organizing superpower and power-line systems with a separate computer "services" system.

It follows, of course, from a development of this sort that units and small systems made for an independent application will be designed beforehand so that from the viewpoint of both hardware and software they will be used as a "building element" in large systems.

However, it is necessary to emphasize that already at the present time reliable data transmission is causing very serious problems and together with the increasing extension of the application of computer technology the amount of data to be transmitted and the demand for higher transmission reliability are increasing; therefore if present communication does not change solidly for the better from the viewpoint of technical parameters, reliability and financial outlays, then it can fundamentally prevent the coming of the polarization trend described. (An indication of this problem is the fact, for example, that the IBM firm in the not too distant past produced not the previously announced 370/200 series, but the 3300 system.)

The satisfaction of security relates also to secrecy, i.e., to data's being obtained only by competent organizations, enterprises and persons. This requirement has posed a general need worldwide to develop methods of coding for networks, like the coding system of the IBM firm published in 1975, which can be easily implemented and have high security.

[85-8831]

8831
CSO: 1863

UDC 681.322.066

OPERATING SYSTEM OF THE 'EL'BRUS-1' MVK SPECIAL PROCESSOR

Moxcow IN-T Toch. MEKH. I VYCHISL. TEKHN. AN SSSR PREPR. in Russian No 15, 1980, 27 pages

TSANG, F. R.

[From REFERATIVNYY ZHURNAL, AVTOMATIKA, TELEMEKHANIKA I VYCHISLITEL'NAYA TEKHNIKA No 9, 1980 Abstract No 9 B132 summary]

[Text] The purpose of the "El'brus-1" MVK [minicomputer complex] special processor (SP) is to provide compatibility between the MVK and computers of the BESM-6 type. Compatibility assumes the ability of the admission to the MVK of routines executed on computers of the BESM-6 type in the non-privileged mode. These routines contain non-privileged operation codes and extra codes; the former are executed by the hardware and the latter are interpreted by the operating system. Since the "El'brus-1" MVK SP command system includes completely the non-privileged commands of the BESM-6 computer, then the required compatibility is made possible by identical interpretation of extra codes by the SP's operating system and the basic operating system of the BESM-6, as which is used the DISPAK operating system. 6 references.

[84-8831]

UDC 681.326.34

MICROPROCESSOR DATA TRANSMISSION CONTROLLER

Riga PROB. SOZDANIYA, PR-VA I PRIMENENIYA SREDSTV VYCHISL. TEKHN. NA OSNOVE MIKRO-PROTSESSOROV I DR. SOVREM. ELEMENTOV MIKROELEKTRON in Russian 1980 pp 61-63

IVANOV-LOSHKANOV, V. S., SEMEMOV, M. N., TRAYNIN, S. B., FAL'KOVICH, E. I., FOGEL', V. A. and FRENKEL', A. M.

[From REFERATIVNYY ZHURNAL, AVTOMATIKA, TELEMEKHANIKA I VYCHISLITEL'NAYA TEKHNIKA No 9, 1980 Abstract No 9 B575 summary]

[Text] A microprocessor data transmission controller (MKPD) is discussed, which is designed for connecting the "Iskra-126" minicomputer to teleprocessing systems as a user station, as well as to a computer network via an interface terminal computer. The controller makes it possible to work through switched or assigned telephone lines in the synchronous and start-stop modes. The data exchange rates are 100, 200, 300, 600, 1200 or 2400 bauds. The MKPD makes possible automatic connection to a line in the presence of a call from the opposite end. The data transmission method is character by character. The MKPD is a message buffer. In the presence of errors the MKPD makes possible reinquiry of the incorrectly received package. The ability to select the data format is provided (odd or even parity check, number of bits of data in a character, number of stop bits). The data transmission control program is loaded prior to the communication session of the controller's working storage.

[84-8831]

USSR PROPOSES TECHNOLOGICAL COOPERATION WITH JAPAN'S ROBOT MANUFACTURER

Tokyo NIKKEI SANGYO SHIMBUN in Japanese 9 Mar 1981 p 6

[Article: "Industrial Robot: USSR Proposed Technological Cooperation With Japan's Robot Manufacturer"]

[Text] The Soviet government recently asked the Japan Robot Manufacturing Company, Inc. (JRM) to participate in cooperative venture in the field of industrial robot technology. The head office of JRM is located in Tokyo and is headed by Kenro Motoda [transliteration]. It is capitalized at 50 million yen. The Soviets said that they sought Japan's robot technology because they considered it urgently necessary to increase their productivity through rationalization and labor-saving efforts, and to relieve factory workers from dirty work. The Soviet government is currently constructing a large-scale robot manufacturing factory in the suburbs of Moscow, and is thinking of importing Japan's robot technology to use in this Moscow factory. The details of the Soviet proposal to JRM are not clear, however, the Soviets are planning to import Japan's most advanced electronic technology in this field, which includes visual and tactile robot sensors.

Earlier this year, the Soviets proposed technological cooperation with the Mitsubishi Heavy Industries, Ltd. in the field of industrial robot technology. This is the first time, however, that the Soviets suggested technological cooperation with a manufacturer that specializes in robots. Based on this, it is considered that the Soviets have begun vigorous efforts to carry out technological exchange with Japanese robot manufacturers.

In the JRM venture, the Soviets wish to acquire robots for handling operations. They are particularly interested in the sensor technology that is essential for handling operations. They also intend to import the microcomputer technology which controls robots based on information obtained through sensors.

In the 11th Five-Year Plan (1981-85) draft, the Soviet government has established a goal to raise productivity through factory automation and to relieve factory workers from dirty work under unfavorable working conditions. To achieve this goal, the Soviet government is promoting an effort to supply industrial robots to factories on a massive scale. The Soviets are building a large robot factory in the Moscow suburbs and are developing a plan to concentrate all of the world's most advanced robot technologies in this factory.

JRM was established in fall 1979 as an independent company formed from the robot department of Motoda Electronics (the main office of Motoda Electronics is located in Tokyo and headed by Kenro Motoda. It is capitalized at 20 million yen), and Toyo Terminal. JRM is a medium size company in Japan with an annual sales totaling 2,500 million yen. It has exported its independently developed handling robots to Sweden's automobile maker Volvo and to the Soviet Union. JRM is also developing various position sensors and systems which simultaneously control multiple robots. JRM considers that the Soviets have appreciated the company's achievement. JRM has already started negotiations with the Soviets and is expecting that both parties will further their negotiations.

Last year, the Japanese robot industry manufactured 22,000 robots and sales totaled 62,000 million yen. It is reported that Japan now has 75,000 operating robots, that is, 70% of the total number of robots in the world. Robot production is expected to increase at an annual rate of 40% for a while and is projected to reach 300 billion yen in 1985. Because the Soviets are very interested in Japan's robot technology, which is the most advanced in the world, there is a strong possibility that the Soviets will propose cooperative ventures with other robot manufacturers.

[141-P]

CSO: 4105

UDC 681.142.353

USE OF CAMAC MODULES FOR DISTRIBUTED CONTROL SYSTEMS

Moscow PRIBORY I SISTEMY UPRAVLENIYA in Russian No 12, Dec 80 pp 16-18

[Article by E. M. Gleybman and V. V. Tarasov, engineers: "Set of Electronic Modules for Distributed Systems for Control of Physical Equipment"]

[Excerpts] One of the widespread standards for electronic apparatus in the world's physics laboratories is the CAMAC modular system of electronic units [1]. It is used extensively in industry, medicine, and other fields today. The assortment of modules produced now numbers more than 1,000.

With the appearance of memory microcircuits and microprocessors it becomes possible to connect a microprocessor controller to the set of CAMAC modules. This controller has a large computing capacity [2]. This, in turn, creates the prerequisites for distributed control systems [3, 4].

This article describes a set of electronic modules which includes an autonomous MIKAM-2 microprocessor controller, which is a further development of the MIKAM-1 controller [5], and memory modules.

The MIKAM-2 autonomous crate controller (see Figures 1 [below] and 2) is constructed in the form of a triple-width CAMAC module and installed in the crate in place of the control station and two standard stations. It provides two-way data exchange between the controller and any CAMAC module; processing and control of interrupts; computations during the collection of data; two-way communication with a teletype and display; communication with the central computer or other MIKAM-2 controllers.

The controller consists of a microcomputer on one printed plate and a CAMAC interface. The microcomputer has a functionally complete Intel 8080 microprocessor (the domestic analog is the K580IK80 [6]), a random access semiconductor memory with a capacity of 1,000 bytes (K565RU2 circuit), a reprogrammable permanent memory with a capacity of 4,000 bytes (Intel 2708 [7]), interrupt control circuits, circuits to receive digital information from the front panel of the controller, a real-time clock, and a sequential interface of the external devices and the commutator.

The RAM-4K random access internal memory unit (see Figure 3 [not reproduced]) is designed to work as a supplementary memory module to the MIKAM-2 autonomous

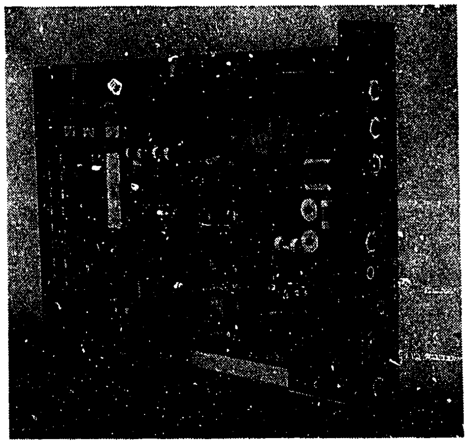


Figure 1. MIKAM-2 Self-Contained Crate Controller

crate controller. The unit has a capacity of 4,000 bytes and a read-write time cycle of 0.6 microseconds.

The storage is built with static Intel 8101 type memory elements with an information capacity of 1,000 bytes per crystal with 256 x 4 positions. It is a matrix with four lines of eight elements apiece. The elements of each line are joined in pairs and selected by one CE signal, forming a memory element that is 256 x 8. The presence of a three-state buffer at the output of the memory microcircuits made it possible to organize a two-directional data line inside the module.

In design terms the RAM-4K module is built in the form of a CAMAC module of ordinary width. Its power supply is +5 volts and it consumes 1.2 amps of current.

The OZU-4K random-access internal memory unit (see Figure 4 [not reproduced]) is a supplementary memory module for the autonomous MIKAM-2 crate controller. The storage capacity is 4,000 bytes and the read-write time cycle is 0.6 microseconds. The storage is constructed of static series K565RU2 memory elements with an information capacity of 1,000 bits per crystal with 1024 x 1 positions. It is a matrix with four columns of eight elements apiece. The eight elements of one column, that is 1,000 bytes, are selected by a CS signal.

The OZU-4K module can be used as a supplementary memory unit of the analyzer. To do this the module control circuit envisions the possibility of adding a unit (one) to the memory cell according to the address coming through the supplementary plug on the back panel. In this mode the OZU-4K module is a memory unit with a volume of 2,000 x 16 digital words.

The contents of the memory cell at the address coming from the plug on the back panel of the module are read into the data register-counter, increased by one, and copied into memory at the same address. The OZU-4K module can work autonomously with an external power source or together with the MIKAM-2 controller. Synchronization of access to storage in the latter case is accomplished by internal control circuits. Up to four modules working with one external source can be joined using a special unit number switch. In design terms the OZU-4K unit takes the form of a CAMAC module of ordinary width. The supply voltage is +5 volts and it consumes 1.7 amps of current.

The OZU-10K random access internal memory unit (see Figure 5 [not reproduced]) is designed to work as a supplementary memory unit for the MIKAM-2 autonomous crate controller. The capacity of the unit is 10,000 bytes.

The storage is constructed with series K507RU1 dynamic memory elements with an information capacity of 1,000 bits per crystal organized in 1024 x 1 positions. It is a 10 x 8 matrix.

The PROM-8K permanent reprogrammable memory unit (see Figure 6 [not reproduced]) is used as a supplementary permanent memory unit for the MIKAM-2 autonomous controller. The unit stores subroutines, constants, and user programs. It has a capacity of 8,000 bytes and a data read time of one microsecond.

The storage is built on an Intel 8702 type permanent reprogrammable memory unit and has an information capacity of 1,000 bits per crystal organized with 256 x 8 positions. This is a matrix of 32 such elements. One of the 32 elements is selected by a CS signal. All the permanent programmable memory matrices are mounted on a panel which permits easy replacement of the memory element in use, when necessary.

In design terms the PROM-8K unit has the form of a CAMAC module of ordinary width. The supply voltage is +5, -24 volts and the current consumed is 900 and 800 milliamps respectively.

Use of the CAMAC modular system with a microprocessor controller and memory modules makes it possible to build inexpensive and flexible distributed control systems for use in physics experiments, medicine, industry, and other technical fields.

BIBLIOGRAPHY

1. "CAMAC — A Modular Instrumentation System for Data Handling Revised. Description and Spacification," Commission of the European Communities, EUR 4100e, 1972.

2. Barnes, R. C. M., "Microprocessors and CAMAC," CAMAC BULLETIN, 1975, No 14.

3. Nemesh, T., Rapp, Kh., Rottel'bush, L., and Slepnev, V.M., "MISKA Microcomputer in the CAMAC Standard, Its Use for Monitoring the Internal Nuclear Beam of the OIYaA [Joint Nuclear Research Institute] Proton Synchrotron," OIYaI Report R10-12077, Dubna, 1979.

4. Glasnek, K.-P, et al, "A Microprocessor System for Calibration and Monitoring of the RISK Experimental Device," OIYaI Preprint R10-12555, Dubna, 1979.

5. Glasnek, K.-P., and Gleybman, E. M., "The MIKAM-1 Self-Contained Crate Controller Based on a Microprocessor," OIYaI Preprint R10-10893, Dubna, 1977.

6. Proleyko, V. M., "Microprocessors, Microcomputers, and Their Development," ELEKTRONNAYA PROMYSHLENNOST', 1979, No 11-12.

7. "MCS-80 User's Library," Intel Corporation, Santa Clara, California, 1977.

[87-11,176]

11,176
CSO: 1863

100-MBYTE COMPLEX BASED ON REPLACEABLE YES5066 MAGNETIC DISC STORAGE DEVICES AND YES5566 CONTROL DEVICES

Kiev UPRAVLYAYUSHCHIYE SISTEMY I MASHINY in Russian No 6, Nov-Dec 80 p 153

[Article]

[Text] The 100-Mbyte complex is a new step in development of the external memory of computers. Compared to the extensively used replaceable YeS5050, YeS5052 and YeS5056 magnetic disc stores (NMD), the YeS5066 device has 13-fold greater capacity and high technical and economic indicators. The YeS5066 external storage device together with other computer equipment permits one to organize a virtual memory in models of the second unit of YeS EVM [Unified computers system].

The typical component of the YeS5066 NMD is a replaceable disc packet which has a standard version and corresponds completely to ISO [expansion unknown] recommendations.

The packet includes 12 discs on which are arranged 19 information surfaces and one special servo surface for accurate positioning of the heads. Each working surface has 411 tracks. Ferrovarnish is used as the magnetic coating of the disc surface.

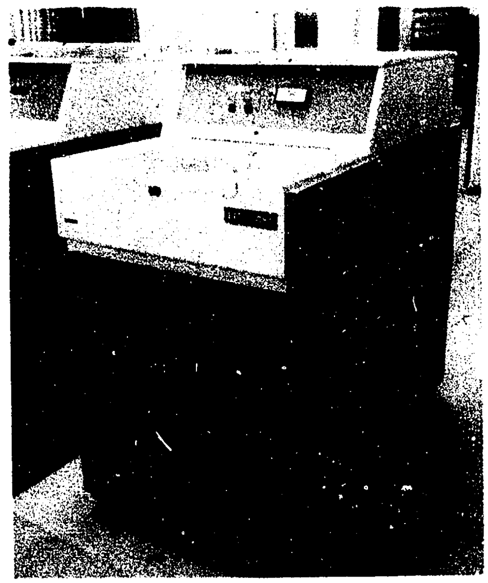
The latest technical advances have been applied in the YeS5066 storage device:

--a line motor for driving the carriage unit holding the magnetic heads (the magnetic heads are made of high-quality ferrite and the floating elements is made of hard ceramic alloy);

--a developed diagnostic system has been implemented which, together with the built-in test system of the YeS5566 control device, provides rapid detection and correction of malfunctions;

--special error correction codes provide high reliability of information storage.

Connecting the YeS5066 storage devices to computers is provided by the YeS5566 control device, which is in turn connected to the computer channel through a standard interface. Using a two-channel switch, the control device can operate in the multisystems mode. Data are transmitted between the control device and the channel by 8-digit bytes with an additional control digit, while they are transmitted between the control device and the storage device digit by digit using cyclic



monitoring of the data files. Microprogramming is used in the YeS5566 device. The developed hardware and software system provides checking of data to be processed, checking of the efficiency of storage devices and search for malfunctions.

The YeS5566 control device is based on a typical rack and extensively uses unification and standardization of assemblies and blocks.

Specifications

Capacity of a single disc packet	100 Mbytes
Method of recording	Modified phase regulation
Linear density of recording	159 bits/mm
Information access time	55 ms
Disc rotational frequency	3,600 rpm
Data transmission rate	806 Kbytes/s
Number of storage devices connected to device	Up to 8
Component base	Integrated circuits and digital components
Overall dimensions:	
YeS5066 storage device	630 X 735 X 1,135 mm
YeS5566 control device	1,200 X 860 X 1,600 mm

[102-6521]

CSO: 1863

UDC 681.327.69'22.022

CONTROL SCREEN DISPLAYS

Serpukhov INSTITUT FIZIKI VYSOKIKH ENERGII. SERPUKHOV. PREPRINT in Russian No 88, 1980 pp 1-10

ANIKEYEV, V. B., DUNAYTSEV, A. F., ZHIGUNOV, V. P., ZOTOV, V. A., KULIKOV, V. A., UTOCHKIN, B. A. and SHAMSUAROV, A. D.

[From REFERATIVNYY ZHURNAL: AVTOMATIKA, TELEMEKHANIKA I VYCHISLITEL'NAYA TEKHNIKA in Russian No 12, 1980 Abstract No 12B693]

[Text] A display with a control screen is a convenient means of interacting with a computer. In structural terms, the controlling screen is made in the form of a transparent mask, superimposed on the screen of the display CRT. Touching a finger to one of the 8 x 8 zones of the mask gives an indication for the execution of an action, the designation of which is written on the screen of the display at the given point. A keyboard answering the needs of the problems being solved can be created by purely programming means on the screen of the display. The engineering aspects of the design are treated as well as the principles of the software for a control screen. Figures 5; references 10.

[91-8225]

UDC 681.327.2

A UNIT FOR INTERFACING THE 15VSM-5 ELECTRONIC KEYBOARD COMPUTER TO PERIPHERALS

Dimitrovgrad NAUCHNO-ISSLEDOVATEL'SKIY INSTITUT ATOMNYKH REAKTOROV. DIMITROVGRAD. PREPRINT in Russian No 26/434, 1980 6 pp

GLUSHAK, N. S., LOGINOV, V. D., KHUDYAKOV, V. A. and SHIPILOV, V. I.

[From REFERATIVNYY ZHURNAL: AVTOMATIKA, TELEMEKHANIKA I VYCHISLITEL'NAYA TEKHNIKA in Russian No 12, 1980 Abstract No 12B714]

[Text] A unit for interfacing computers of the 15VSM-5 type to peripherals (PU), incorporated in the multichannel radiometric system for data collection and processing, is described. The interface serves for the organization of data exchange between the 15VSM-5 computer and the peripherals in accordance with the program specified by the 15VSM-5 computer. The form of data representation in the peripherals is either binary or binary-decimal. The number of data bits is 24 and there are 6 binary-decimal bits. The number of peripheral addresses in the interface system runs up to 510. The interface generates the number of the requisite word length from a series of byte transmissions from the 15VSM-5 computer, transmits the number to the peripheral and provides for byte-by-byte reception in the computer of the number of the requisite word length from the peripheral. Moreover, the interface receives from the computer and transmits the address of the peripheral with which the communications are carried on. The binary data incoming from a peripheral is also converted in the interface to the binary-decimal form needed for its reception in the 15VSM-5 computer. In structural terms, the coupling interface is designed as a unit of double width to the "Chereshnya" standard. All of the assemblies of the unit are designed around series 155 IC's with an overall number of about 200 packages. Figures 2; references 1.

[91-8225]

UDC 681.584.782

A STUDY OF THE OPERATIONAL CAPABILITY OF RELAYS WITH HERMETICALLY SEALED CONTACTS

Riga RAZVITIYE, VNEDRENIYE I EKSPLUATSTSIYA SREDSTV SVYAZI. VSESOYUZNYY NAUCHNO-TEKHNICHESKIY SEMINAR, RIGA in Russian 1980 pp 65-66

KALININA, K. G., LUKS, A. G., PETERSON, L. P. and SILIN'SH, Ya. Ya.

[From REFERATIVNYY ZHURNAL: AVTOMATIKA, TELEMEKHANIKA I VYCHISLITEL'NAYA TEKHNIKA in Russian No 12, 1980 Abstract 12A29 by A. M. Pshenichnikov]

[Text] The results of a study of type RPS domestically produced hermetically sealed contact relays and RGK-27 and RGK-36 relays produced by the German Democratic Republic are presented. During testing of the contacts for the effect of vibration, the noise and pulse resistance as well as the number of open circuits per unit time were determined. The minimum value of the acceleration at which a sharp increase in the noise resistance was observed at the resonant frequency was 2.5 m/sec^2. The RGK-36 relays proved to have the highest quality based on the test results.

[91-8225]

UDC 681.323

DEVISING EQUIPMENT INTERCHANGES FOR SMALL-COMPUTER CONTROL COMPLEXES

Moscow PRIBORY I SISTEMY UPRAVLENIYA in Russian No 12, Dec 80 pp 6-8

[Article by S. I. Samarskiy, candidate of technical sciences: "Organization of Efficient Control Systems Based on SM-3 and SM-4 Control Computing Complexes Using UVM M-6000, M-7000, SM-1, and SM-2 Peripheral Equipment"]

[Excerpts] Development of the architecture of the system of small electronic computers (SM EV) has taken two basic directions. The first models SM-1 and SM-2 with system interface 2K [1] were based on the small M-6000 and M-7000 computers. The architecture of the later models SM-3 and SM-4 with the system interface OSh ("common line") [2] was based on the architecture of small M-400 computers.

The control complexes of the SM-1 and SM-2 have a broad assortment of units for communication with the object (USO's) because all the peripheral devices developed for the M-6000 and M-7000 control computing complexes, in particular the devices for communication with the object, can also be used generally in the SM-1 and SM-2 control computing complexes. In addition, a number of new modules of devices for communication with the object have been developed or are in the development stage for the SM-1 and SM-2 complexes.

During development of peripheral equipment for the SM-3 and and SM-4 control computing complexes attention was focused on system devices. As a result a shortage of peripheral devices for communication with the object occurred.

The Kiev Electronic Computing and Control Machine Plant developed and has begun producing a general-purpose device to match the OSh and 2K linkages. This device, the USS OSh/2K, makes it possible to use peripheral equipment from the SM-1, SM-2, M-6000, and M-7000 control computing complexes (including a broad assortment of modules for communication with the object) in the SM-3 and SM-4 complexes. This is useful not only because it eliminates the above-mentioned shortage and makes it possible to avoid duplication in development work, but also because it permits efficient use of modules for communication with the object in the SM-3 and SM-4 control computing complexes.

In order to have identical or similar system characteristics for the complex when it is using both its own and external units of the complex that are

APPROVED FOR RELEASE: 2007/02/08: CIA-RDP82-00850R000300100055-7

connected to it through the matching unit, this unit must be built so that the service program of the borrowed external device "does not know" that it is connected to the complex through the matching unit. In other words, this program should not contain actions that are determined by the presence of the matching units.

The system characteristics of the SM-3 (SM-4) complex with external devices of the SM-1 (SM-2, M-6000, M-7000) control computing complex are determined by how the device for matching the OSh and 2K interfaces (the USS OSh/2K) is made.

The efficiency of the method chosen for matching the OSh and 2K interfaces depends entirely on taking full advantage of the strengths of these interfaces and avoiding their shortcomings. Let us consider the 2K and OSh system interfaces to evaluate the effectiveness of different ways of constructing the USS OSh/2K.

Series production of equipment for communication with the object for the SM-3 and SM-4 control computing complexes (RSS OSh/2K expanders and frames for units for communication with the object) with software was incorporated in 1980.

The USS OSh/2K and RSS OSh/2K devices make it possible to connect a broad assortment of 2K peripheral equipment to the SM-3 and SM-4 complexes. Using modules of devices for communication with the object from the equipment of the SM-1 and SM-2 complexes in the SM-3 and SM-4 complexes makes it possible to build efficient control systems without developing OSh peripheral equipment.

In addition to connecting VU2K and SM-3 and SM-4 complexes the USS OSh/2K unit may be used to organize multimachine computing complexes with SM-1, SM-2, SM-3, SM-4, M-6000, and M-7000 control computing complexes. Two duplex registers connected by cable are used for this purpose to organize two-way exchange of data files between the SM-3 (SM-4) and the SM-1 (SM-2, M-6000, M-7000) control computing complexes. One of them is mounted in the USS OSh/2K interface module and the other at the appropriate interface point in the SM-1 (SM-2, M-6000, M-7000) control computing complex. The duplex register is a VU2K arranged on an interface printed plate and designed to organize two-way data exchange among the SM-1, SM-2, M-6000, and M-7000 complexes.

It is possible in principle to organize analogous multimachine complexes including SM-3 and SM-4 units. To do this two USS OSh/2K's and two duplex registers are used in each case to organize two-way exchange among the complexes.

Figure 2 [not reproduced] gives a schematic diagram of the organization of multimachine control computing complexes containing SM-3 (SM-4) and SM-1 (SM-2, M-6000, M-7000) units.

1. "OST [All-Union Standard] 25-721 — 78. The 2-K Interface."

2. "OST 25-795 — 78. The 'Common Line' Interface."

[87-11,176]

11,176
CSO:1863

UDC 1.327.2:621.318.13

FOUR TECHNOLOGIES FOR MAKING SMALL MAGNETIC ACCUMULATORS COMPARED

Moscow PRIBORY I SISTEMY UPRAVLENIYA in Russian No 12, Dec 80 pp 34-35

[Article by I. P. Dorofeyeva, T. L. Kiyskyula, and A. A. Khramov, engineers, and candidate of technical sciences G. D. Timofeyev: "Selecting Technology for the Manufacture of Small-Capacity Magnetic Internal Memory Units"]

[Text] Iskra-type electronic programmable keyboard control register and bookkeeping machines are now in series production. They use a magnetic internal memory unit based on a module with a capacity of 1,000 bytes (1,000 x 8 internal memory) organized on a 3 x 4W system with ferrite cores one millimeter in diameter (see Figure 1 [not reproduced]). Because the volume of production of these machines is running into thousands a year and shows a tendency to continue increasing, it has become necessary to select and implement technology for making the basic (in terms of specific cost and labor-intensiveness) assembly of the memory unit, the magnetic accumulator (see Figure 2 [not reproduced]). The technological process of wiring a small-capacity (1,000 x 8) magnetic accumulator should provide high-quality manufacture with minimal labor-intensity and cost.

There are four main ways today of wiring ferrite core accumulators: manual, manual using masks, mechanized, and fragmentary using masks. Calculations of the labor-intensity of wiring magnetic accumulators by these four methods are given in the table below.

Manual wiring of the OZU 1,000 x 8 magnetic accumulator is done with a relatively simple apparatus. The ferrite cores are set on the wires of the coordinates which are then secured in the apparatus for wiring. When wiring the lines of the second coordinate the wiring worker manually orients the position of each ferrite core according to the diagram for the magnetic accumulator. The "Read" and "Inhibit" lines are wired manually in sequence. This method of wiring is simple. It does not require significant expenditures to manufacture the pieces. Its drawbacks are the high labor-intensity and inevitability of errors when the ferrite cores are oriented manually.

For manual wiring using masks the main things needed are the masks themselves and an apparatus to hold them. The mask is a bronze plate with holes arranged according to the topology of one bit position of the magnetic accumulator. The holes in the mask are filled with ferrite cores on a special device. A needle is soldered to the end of the installation wire for convenient wiring. All four lines are wired manually.

	Manual	Manual-Using Masks	Mechanized	Fragmentary Using Masks
Number of Assemblers	1	1	2	1
Apparatus, Devices	Apparatus	Apparatus, Masks	Set of devices	Set of devices, masks
Adjustment and Servicing of Apparatus and Devices	-	-	Adjustment and Servicing	
Labor-Intensiveness of Preparing Apparatus and Devices for Wiring, in norm-hours	-	4 *	1	4
Labor-Intensiveness of Wiring in Norm-Hours				
First Address Lines	1.5*	1.5*	3	0.5
Second Address Lines	28 *	1.5*	0.5	0.5
Read and Inhibit Lines	18 *	18 *	18 *	18 *
Total in Norm-Hours	47.5*	25 *	22.5*	23

Note: The labor-intensity figures marked with the asterisk (*) have been confirmed directly for the OZU 1,000 x 8 magnetic accumulator by experimental data

---

The labor-intensiveness of wiring is decreased by the use of masks. The need for complex equipment is eliminated and there is complete freedom in orienting the ferrite cores. The number of terminals of the magnetic accumulator is two-fifths of the number with manual wiring. In addition, it is possible to reduce the clearances between the cores significantly, which improves the quality of the magnetic accumulator because the number of microcracks and punctures in the ferrite cores occurring during wiring is reduced. The spread of this technology is being held back somewhat at present by the relatively high labor-intensiveness of making the masks.

Mechanized wiring was developed at the computing center of the Siberian Department of the Academy of Sciences USSR for large-capacity magnetic accumulators and has been implemented at a number of enterprises with series production. The proposed technology makes it possible to put the ferrite cores on the assembly wire automatically and wire the lines of the second coordinate with an assigned orientation of the ferrite cores. The other two lines are wired manually. This method of wiring requires complex and expensive equipment, plus two wiring workers working together, and constant qualified adjustment and servicing of the equipment.

A fragmentary technology has now been developed to wire magnetic accumulators using masks. After they are filled on a special device the masks are secured to a setting table which then moves in the direction of the assembly wire. The wire assumes the appropriate direction and enters the rank of ferrite cord being wired. The second coordinate is wired in the same way. Five-ten percent of the rank of ferrite cores of the magnetic accumulator are examined manually. Manual wiring of the last two lines is still used. This device is expensive to manufacture and needs constant, qualified servicing.

As the table shows, manual wiring requires the greatest labor input. The other three variations differ from one another in labor intensity by less than 10 percent. However, the last two alternative wiring technologies involve significant initial expenditures to manufacture the equipment and for subsequent qualified servicing of each unit. A gain of just 10 percent in labor-intensiveness does not justify the manufacture and operation of complex equipment for mechanized wiring or the fragmentary technology.

On the basis of this analysis we recommend that small-capacity magnetic accumulators be wired manually using masks. These recommendations have been implemented successfully at several enterprises which are producing small-capacity magnetic internal memory units, above all the OZU 1,000 x 8 module.

[87-11,176]

11,176
CSO:1863

MICROPROCESSOR SYSTEMS

NEW BOOK DISCUSSES MICROPROCESSOR SYSTEMS

Moscow MIKROPROTSESSORNYYE SISTEMY in Russian 1980 (signed to press 26 Jun 80) pp 2, 5, 236-237

[Annotation, excerpt of introduction, and table of contents from book "Microprocessor Systems", by Iveri Varlamovich Prangishvili and Gennadiy Georgiyevich Stetsyura, Izdatel'stvo "Nauka", 9,750 copies, 240 pages]

[Excerpts] Annotation

This book reviews the structures and interaction procedures of microprocessor modules in data processing systems and the organization of multimicroprocessor distributed and concentrated control systems. It describes the interaction procedures of processors in data processing systems. Various methods of switching in systems and control of data exchange are presented. The authors identify solutions that afford rapid interconnection of units with simple connecting structure. Decentralization of control of data exchange is considered. The book offers a number of control structures and algorithms oriented to different classes of systems. The influence of the mechanism of interaction on the possibilities of executing computations in the system is demonstrated. The book includes a survey which allows an assessment of the possibilities of performing parallel computations in multimicroprocessor systems and reviews the most noteworthy concepts of multimicroprocessor systems published in recent years.

The book contains 17 tables, 136 illustrations, and 190 bibliographic entries. The responsible editor of this work is E. A. Trakhtengerts.

Introduction

This book attempts to evaluate which concepts in computer technology and associated areas are beginning to influence microprocessor technology and may be used to organize microprocessor data processing systems.

The book reviews the basic features of the structure of microprocessors, the organization of concentrated and distributed multimicroprocessor systems, and the requirements imposed on them. It describes interaction procedures for processors in data processing systems and the effect of the organization of connections among technical devices within the system on these procedures. It considers the execution of parallel computations, one of the important spheres of application of microprocessor systems. There is further consideration of various methods of organizing links in the system, methods of switching information sources and receivers, and control of data exchange. Concepts which afford rapid interconnectio of devices with a simple connecting structure are singled out. Therefore, attention is given to systems with standard bus structure, which is widespread both in microprocessor systems and in the apparatus with which microprocessor systems must interact. One of the chapters reviews the issues of data protection, which are particularly interesting for distributed systems. The book presents the results of work done on decentralization of control of data exchange at the Institute of Control Problems of the Academy of Sciences USSR. A number of control structures and algorithms oriented to different classes of systems are given. The authors demonstrate that these algorithms can be applied to the organization of computations in a common channel. Computation in a common channel is proposed as the development of the technology of associative memory devices for multiprocessor and distributed systems which in many cases permits replacement of work with memory devices by processing signals sent by components of the system into the common channel. The final chapter describes the most noteworthy multimicroprocessor systems discussed in the published literature in recent years.

Because the terminology of microprocessor systems, particularly distributed ones, is not firmly established yet, a number of the terms used in the book should be viewed only as tools essential for writing the book.

Table of Contents

Page

[112-11,176]

11,176
CSO: 1863

INSURING SECURITY OF MICROPROCESSOR DATA PROCESSING SYSTEMS

Moscow MIKROPROTESSORNYYE SISTEMY in Russian 1980 (signed to press 26 Jun 80) pp 143-154, 226, 232-233

[Chapter 10 from book "Microprocessor Systems", by Iveri Varlamovich Prangishvili and Gennadiy Georgiyevich Stetsyura, Izdatel'stvo "Nauka", 9,750 copies, 240 pages]

[Excerpts] Chapter 10. Protection (Security) of Data Processing

Data processing security is important in microprocessor systems chiefly for distributed systems because of the great dispersion of data storage and processing means, the possibility of human intervention at many points in the system, and the existence of common communications lines.

Data processing security comprises the security of the information stored and being processed in the computer (including programs) and the information being transmitted by communications lines between data sources, processing devices, and receivers. The topic also encompasses confirmation of the individual subscriber.

We will cite examples of distributed microprocessor systems that need data processing security.

1. The information reference system. The system should provide security of information against unauthorized reading and alteration. Information being transmitted to a user terminal should not be acceptable to a third party.

2. The automated control system. Because perfectly adjusted systems do not exist for practical purposes, programs and data must have mutual security against distortions and provide monitoring of the work of control personnel. The system should be confident that the control order comes from a person who has authority to issue it. The system should also display, at any moment, convincing proof that it has received an order from precisely this party.

The situations considered in the examples do not necessarily presuppose an illicit intention. Unauthorized access may occur because of equipment malfunction; a terminal connected to the common line may incorrectly decode an address and print out the wrong document. The signature under the document is generally a commonly accepted norm. Until recently, however, there were no means of creating a reliable "electronic signature" which could be transmitted in digital form within the system.

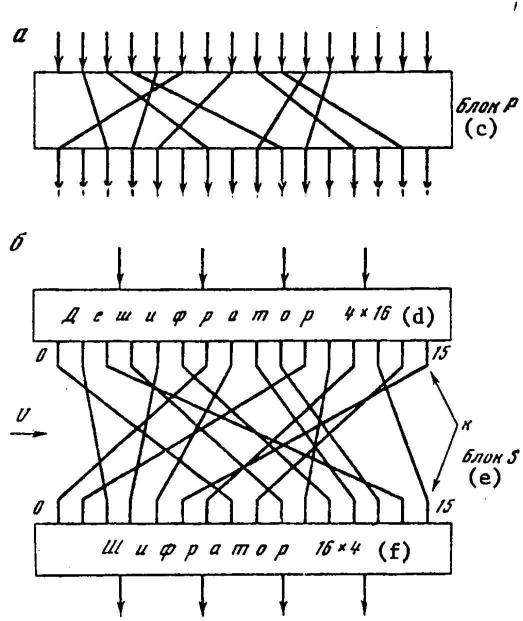
At the same time, as numerous publications show, the illicit intention cannot be ignored either. Thus, if key-type security that is adequate in ordinary conditions is used, it must be remembered that there may be attempts to decipher the key. An attempt may be made to forge a signature, and a third party achieving communication with the computer may attempt to take information out of the machine, intercepting it for himself.

Below we will briefly describe the principal methods of data security.

10.1. The Cryptographic Approach To Data Security

The cryptographic method of data security described below was developed at IBM and formed the basis for the standard adopted by the U. S. National Bureau of Standards [10-1-6]. It was based on C. Shannon's work on cryptography published in 1949 [10-2]. We will consider two types of convertors.

In Figure 10.1 below block P performs rearrangements. Each of its inputs is connected electrically with just one output (Figure 10.1 does not show all the connections). Block S performs substitutions. The decoder converts



Key: (a) Rearrangement P;
(b) Substitution S;
(c) Block R;
(d) 4 x 16 Decoder;
(e) Block S;
(f) 16 x 4 Coder.

Figure 10.1. Code Convertors

the binary code to an output signal at its output. The outputs of the decoder (points k) are connected with the inputs of the coder on the basis of a certain reordering. The coder forms the binary code again at the output. For example, the code 0011 at input S (Figure 10.1) is converted to code 1111 at the output. Two mutually reversible rearrangement connections can be established between the decoder and the coder and the binary control signal U selects one of them. The cryptographic system is structured from absolutely identical connections between blocks P and S (see Figure 10.2 below). Vector $\bar{U}$ is a key which sets one of two connections in each of the modules of S depending on the corresponding bit position of $\bar{U}$. (For the sake of simplicity most of the connections between blocks P and S have been omitted from Figure 10.2). The strong relationship between bit positions is a distinguishing feature of this kind of connection. Figure 10.2 shows signal 1 fed to the only input of the circuit is converted into seven units at the output. Therefore, a slight error at the input substantially distorts the output. Changing key $\bar{U}$ completely alters the behavior of the circuit. In principle, block S taken separately is a good cryptographic device if it is large in size. However, it is practically impossible to make such a block.

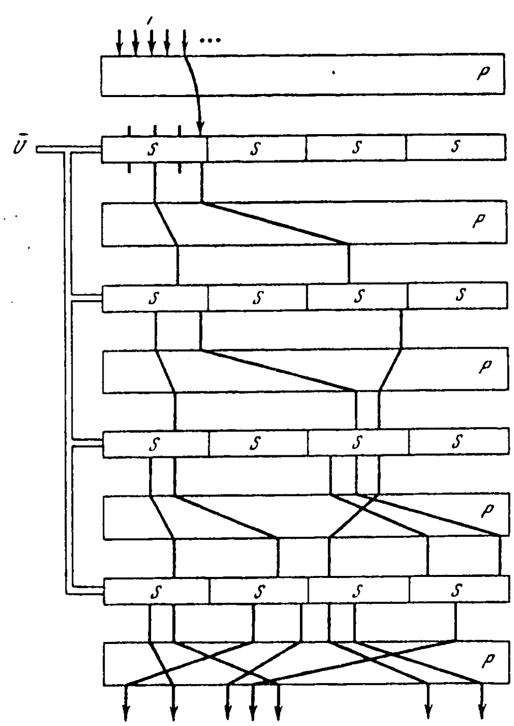


Figure 10.2. Sequential Connection of Blocks P and S

Indeed, if we take S as having five inputs, the number of points k in it is $2^5 = 32$ and the number of possible interconnections is 32! This is a fairly large number. However, such a cipher is easily subjected to frequency analysis because the five inputs are precisely what is necessary to encode one letter of the alphabet. Therefore, frequency analysis of the coded text easily identifies the unknown correspondences of letters at the input and output of block S. The list of possible input and output characters here is very small (32) and it can be studied easily.

But if the number of inputs is taken to be much larger, for example 128, the number of possible "characters" is 2^{128}, which is too large for analysis. But a block S with 128 inputs must have 2^{128} points k (see Figure 10.2); that is, it cannot be built. Blocks P are not suitable for constructing a decoder (although they are simpler to perform for a large number of inputs); by feeding one unit to the input it is possible to determine immediately the output corresponding to it.

With the structure shown in Figure 10.2 it is possible to obtain good security with relatively low complexity because although the blocks S here are small, their outputs go to block P, which performs a rearrangement within the limits of a much larger bit format. The result is a structure whose internal organization is very difficult to decode. If $\bar{U}$ contains 128 bit positions, it will be necessary to sort through 2^{128} combinations of states of block S for decoding.

If the working speed is not critical, a multilayered scheme (see Figure 10.2) can be made by introducing feedback to one layer. The message can be decoded by passing it through a similarly organized circuit in which the blocks perform the inverse conversion (see Table 10.3 below).

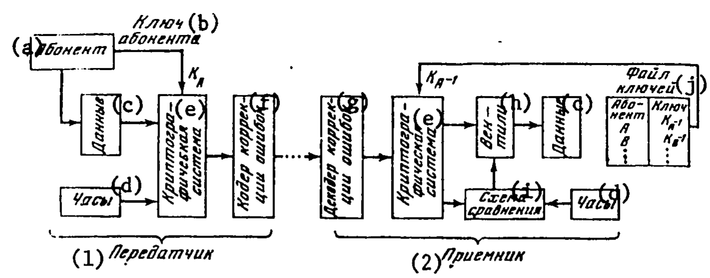


Table 10.3. Cryptographic System

Key:
- (1) Transmitter:
- (2) Receiver;
- (a) Subscriber;
- (b) Subscriber Key;
- (c) Data;
- (d) Clock;
- (e) Cryptographic System;
- (f) Error Correction Coder;
- (g) Error Correction Decoder;
- (h) Gates;
- (i) Comparison Circuit;
- (j) Key File [left hand column — "Subscriber"; right hand column "Key"].

Let us demonstrate how this procedure can be used to establish the authenticity of a source using the example of the work of the system shown in Figure 10.3. The connection between the source and the receiver is accomplished by the following scheme.

Subscriber A communicates his name to the receiver in open code. Receiver A finds the decoding key K_{a-1} corresponding to this subscriber and enters it in its cryptographic system. Subscriber A sets his own key K_a in the transmitter cryptographic system. The receiver and transmitter have mutually synchronized clocks. The clock readings must be identical. The encoded message is very sensitive to interference, so an error correction system is installed at the output of the transmitter and the input of the receiver. After receiving authorization from the receiver, subscriber A begins transmitting information. The information arrives in blocks on the upper half of the inputs of the cryptographic system. Clock readings arrive in the lower half. After decoding the message the receiver compares the counter reading received with its own readings and, if they coincide, accepts the block of data that has arrived.

In such a system the receiver and transmitter may establish the authenticity of the other party because it is difficult to forge the keys. Moreover, it is impossible to use a correct but improper text to create interference. For example, it is not possible to make a tape recording of improper information and use it later to falsely trigger the system. Because transmission of the recording will be done later than transmission of the original, the clock readings of the transmitter and receiver will not coincide and the message will not be accepted. In this case the clock reading plays the role of a password. In this system, however, the receiver can forge transmitter messages. Therefore, such a "document" has no legal force.

10.2. Cryptosystems with a Public Key (Public-Key Systems). Methods of Obtaining a Digital Signature

The method of using a key to protect information requires that the keys be delivered to subscribers by a safe channel (for example by messenger). This is a slow procedure and not suitable for situations where an unforeseen connection must be established, because there will be no key for this situation. The question naturally arises: is it impossible to transmit the key on an open channel? The classical answer until recently was that it was not possible. In 1976, however, the opposite answer was given to this question [10-7-9].

In cryptographic system with a generally accessible key, coding and decoding are controlled by different keys E and D which are such that it is practically impossible to compute D on the basis of E (for example, it requires performing 10^{100} operations). The key E_i of subscriber A_i is stored in a general-access reference. Practically no one except A_i will be able to decode the encoded message.

To be more precise, E and D should have the following properties:
1) $D(E(M)) = M$, where M is a random message from the set of permissible

messages {M}; (2) E(M) and D(M) are easily computable; (3) knowing E does not in practice permit computing D; (4) E(D(M)) = M.

The fourth property is necessary only to receive a digital signature (see below)

To transmit message M to receiver A_i, source A_j takes the coding key E_i of subscriber A_i from the reference and encodes the message using it: $N \rightarrow E_i(M)$. Because of property (3) no one except A_i can decode E_iM. Therefore, A_i performs the operation $D_i(E_i(M)) = M$, that is, decodes the message (property (1)). Because of property (2) the source and the receiver must perform fairly simple computations to process the message. Finding good keys E and D is a problem [10-9-15].

Now let us turn to the question of the digital signature. This problem differs from establishing authenticity where it is sufficient for the receiver to ascertain that the message to him is, in fact, coming from the particular source. The signature must have legal force, and it must be inseparable from the particular document. The procedure for subscriber A_j to receive the signature of subscriber A_i is given below.

1. A_i puts signature S on document M: $S = D_i(M)$, where D_i is conversion of the decoding of subscriber A_i;

2. A_i encodes S with generally accessible key E_j of subscriber A_j and sends $E_j(S)$ to A_j;

3. A_j receives S from $E_j(S)$, that is, $D_j(E_j(S)) = S$;

4. A_j, using generally accessible key E_i, receives M from S, that is, $M = E_i(S)$ (property (4) was used).

Thus, the pair (M, S) is a document with signature and the equality $E_i(S) = M$ serves as proof of the receipt of M from A_i.

Subscriber A_j cannot forge the document $(M \rightarrow M')$ because to do so it is necessary to obtain signature $S' = D_i(M')$, and this is not possible for A_j.

The digital signal can become very widely used. For example, when specialized integrated circuits that perform the conversions E and D quite well are produced it is possible to document telephone orders, giving each spoken word a signature.

10.3. Security of Programs and Data in the Computer

The methods of coding reviewed in the preceding section insure preservation of data during its transmission outside the data processing system. The techniques are also an important element of intrasystem security, but they alone are not adequate because the object stored in the computer may have fairly complex organization and enter into complex interrelationships. The organization of security that is adequate to these structures should be worked out accordingly. When it is necessary to guard the system against accidental malfunctions fairly simple protection circuits are usually used. But these circuits cannot prevent the dangerous dissemination of errors in the system. Moreover, poor protection usually provides little or no record of the events, which makes it more difficult to detect and eliminate the cause of the error. Deliberate interference is potentially possible in collective-access systems and the lack of protection against it undermines faith in the system. Below we describe procedures for protection against random and deliberate interference. The survey work [10-10] contains an extended bibliography on this question.

It should be noted first that it is practically impossible to add means of protection later to systems that do not contain them. Therefore, protection (if it is considered essential) should be introduced in the early phases of designing the system.

There are three types of disruptions that a security (protection) system should control: unauthorized reading of information; unauthorized modification of information; unauthorized obstruction of access to information (in particular, program distortion).

The security mechanism depends significantly on the functional capabilities of the system. The "all or nothing" principle is often followed. This is where users are mutually isolated, but have access to common information. If a user is authorized to make entries in common information, these entries become generally accessible. Self-virtualizing machines are a typical example (see below).

In a more complex example it may be necessary to protect highly diverse objects (data and program structures) which are interconnected. The need for dynamic change in authorizations introduces significant complexities. In addition to indicating who can do what with the object, more subtle limitations that take into account the properties of the object may be encountered. For example, "Access is authorized only during the working days of the week from 0930 to 1815."

The following principles are noted in the literature for constructing a security system.

1. The mechanism of protection must be simple, compact, and easily surveyed. Otherwise it will be difficult to guarantee its effectiveness.

2. Authorizations should prevail over inhibitions. The normal regime is lack of access. With this approach it is easier to detect errors than in systems that are based on inhibitions.

3. Protection should not be constructed on the basis of secrecy of the protective mechanism; this is difficult to insure. A very small part of the information should be secret.

4. A minimum range of authorization necessary to execute its work should be established for every program. This reduces the damage done by disruptions and simplifies the search for a disruption.

5. Each protection mechanism should depend minimally on the other mechanism (see also point 1 above).

6. The monitoring of disruptions should be all-encompassing, covering all parts of the system in any state.

7. It is desirable to have a record of attempted disruptions.

8. It is desirable to decentralize protection; centralized storage of the information that controls access cannot be relied upon.

The simplest form of protection is complete isolation of users. Let us consider this kind of protection using the example of self-virtualizing machines, a variation of virtual machines [10-11-13, 10-16]. With respect to software realization, a self-virtualizing machine requires at least one additional level of control compared to conventional operating systems: a monitor of control of system resources. User jobs are performed under the control of the operating systems they select, but the systems are executed in the job regime. When they must organize access to some physical resource, they refer to the control of system resources, and only it in fact distributes the resources. Because in the particular case operating systems can serve a small number of users, they are relatively simple and control of system resources also performs limited functions. One of the chief purposes of this organization is to work with programs and operating systems that have not been debugged and to insure reliability, safety, and security.

The hardware should have a built-in data security apparatus in order to design an effective self-virtualizing machine. Figure 10.4 below shows one of the possible diagrams. The system has a relative base addressing mechanism. When one process A_i of the set of processes performed by operating system OS_A is generated, OS_A (monitored by the system for control of system resources) identifies the address of the memory domain ΠA_i and formulates the state word of this process. This word indicates the descriptor that contains the base (B) and the maximum shift (MS). The sign C_2 indicates the permissible work regime in the identified memory domains: write, read, unlimited. We will describe the sign C_1 below. For the work process A_i, its state word (A_i) should be set in control register R. The command which requires reference to memory contains a positive shift relative to the base. During the performance of such a command the shift is added to the value of the base indicated in the state word (A_i). If the address for access to memory obtained in this case goes outside the boundaries of the interval [B, MS], hardware control blocks memory access.

A single process may require several state words, and it is wise to have a group of registers {R} and indicate the necessary register in the command to avoid having to replace the contents of register R frequently.

Sign C_1 in the state word of the process is used to describe the type of data contained in the memory domain corresponding to the given state word [10-14]. Suppose C_1 = a means that the state word of the process is stored in a particular domain of the memory unit. We will divide the set of commands (of the user and operating systems) into two subsets: M_1, which is

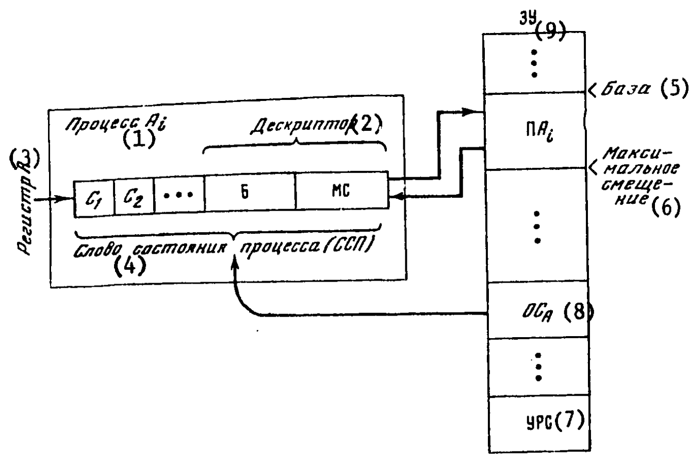


Figure 10.4. Simple Protection Mechanism

Key: (1) Process A_i;
(2) Descriptor;
(3) Register R;
(4) State Word of Process;
(5) Base;
(6) Maximum Shift;
(7) Control of System Resources;
(8) Operating System A;
(9) Memory Unit.

---

commands for work with the state word of the process, and M_2, which is commands for work with other information. We will consider that: (1) the set of registers {R} is accessible to the user process being performed at the particular moment; (2) access by a command from M_2 to the memory domain with C_1 = a is blocked; (3) commands from M_1 may refer to the memory domain with C_1 = a, but they cannot change the descriptors. They can only move the state word of the process from one place in memory to another (the control of system resources must be involved to convert the descriptor).

Now the process A_i, using commands from M_1, can select any sequence of state words (A_i) from the memory domain accessible to it at the given moment. Thus, the set of memory domains accessible to the process will change dynamically. Some of the state words of the process (A_i) can be placed in a memory domain acceptable only to the operating system A and will be presented only to processes under its control. This protection mechanism is flexible and at the same time reliable.

The same kind of security mechanism can be used for multimicroprocessors concentrated and distributed systems. In these cases several physical processors allocated for work with specific processes will exist concurrently. These processors will have their own sets of control registers, each of them isolated from intervention with other processes. Instead of one memory unit (see Figure 10.4 above), now a group of memory units can be used with uniform or individual addressing of memory blocks. Its control in such a system is distributed between elements of the microprocessor system, a group of interacting modules for control of system resources will appear instead of one common control module for these resources.

The location of the protection mechanism may be significant in a distributed system. It may be desirable to separate the mechanism for shaping the address, which is located in the user processor, from the protection mechamism, to put the latter in a more protected place (near the protected object, at the inputs to the system, and so on).

Figure 10.4 above described a single mechanism for addressing and security. But it can be considered that Figure 10.4 depicts a pure protection mechanism in which the descriptor only monitors the boundaries [B, MS], while addressing proper is done in a completely random manner in another unit. Therefore, the protection mechanism may be spatially removed from the addressing mechanism.

The diagram represented in Figure 10.4 is often complicated by the introduction of segments (see Figure 10.5 below).* With segmental organization the command contains a segment name that is in no way related to the place of storage of the segment in memory. The system should have a hardware mechanism that makes it possible to find the state word of the process corresponding to the segment name by a table of correspondences.

Correspondence Table

Segment Name → State Word

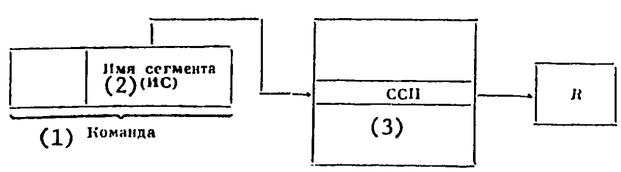


Figure 10.5. Protection Mechanism with Segments

Key: (1) Command;
(2) Segment Name;
(3) State Word of the Process.

The state word found is placed in register R, and then it can be used as it was in Figure 10.4.

* We are interested here only in questions of security; for detailed treatment of segmental organization and evaluation of it see [2-5, chap. 4].

The table of correspondences serves as one more barrier between the object being protected and the user. Removing the deprives the user of access to the object.

It should be noted that less flexible security systems than those described are often employed in computers. In these cases there is no control of system resources, user programs work under the control of a general operating system, registers {R} are not accessible to the user, the state words of the process are stored in a protected memory domain belonging to the operating system, and only the operating system can form the state word of the process and copy it into {R}.

These security systems are an example of what are called mandate systems [10-10]. In them the user must present a mandate (an "admission ticket") for access to the object protected; in our case this is the value of the base and the segment name.

The mandate may be encoded as described above to enhance security. The digital signature provides a high degree of security. This offers an opportunity for the system to certify the authenticity of the user and for the user to be certain that he is connected with the necessary system. It is also important that the signature makes it easier to document system work. On the other hand, this kind of monitoring slows down the work of the system and it should be used cautiously. In general, it is not expedient to have a single method of protection in a system; on the contrary, the system should have a hierarchy of means or protection with different levels of speed and reliability. The part of the system which is difficult to disrupt can be monitored by simpler means. For example, protection of the input points of the system from remote users should contain a test of the digital signature; within the system mandates alone are sufficient.

Let us briefly describe the security usually accomplished by software. The mandate system may assume more complex forms than the one described above. Figure 10.6 below shows such a system [2-5]. Here there is a group of domains {D}, to which the processes {P} (processes here may also mean the user) and the objects being protected {O} are connected. The domain determines the conditions of access to the group of objects which it is protecting. The conditions may be of random complexity, and the domain is realized in the form of a program. The path from the process to the object must pass through the domain.

If there are fewer domains than processes, which is usually the case, it is easier to analyze the barrier created by the domains and it is easier to control it by adjusting the domains. Access of processes to the domains may be accomplished by the procedures described above with hardware support.

Systems with access lists are used in addition to or instead of mandate systems. These are usually program systems. In this case each input is protected from outside on the basis of a list which includes the names (or digital signatures) of users. When a request for access is received a check is made against the list and if the list contains an authorization,

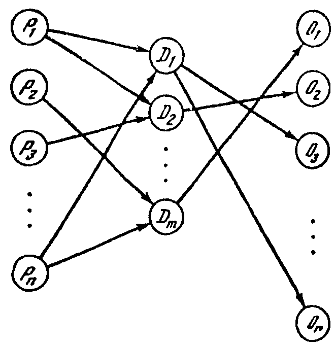


Figure 10.6. Protection Mechanism Employing Domains.

access is permitted. For example, it may prove necessary to protect certain domains in the system shown in Figure 10.6 above by access lists.

In the cases considered in Figures 10.4 and 10.5 the objects are series of main memory cells (pages, segments) or peripheral devices in systems where such devices are addressed as memory cells. With program security the object may be of any nature.

The set of objects to which user access is authorized at the given moment is called a zone.

Let us introduce the concept of the "protected subsystem." The protected subsystem is a set of procedures and data contained in a protected zone. The data are accessible only to procedures that enter the protected zone, and these procedures may, in turn, be called up only through the input points given for the particular zone. Thus, programs which are external to the protected subsystem do not have access to the stored data. Naturally, if they have the right to access they can submit a query to the subsystem. After the query is processed the customer receives a response. Queries from the subsystem can only be issued through the input points under control of the security program. This is important, for example, when foreign programs or programs that have not been debugged are stored in the protected subsystem and their removal from the subsystem must be monitored. The operating system may serve as an example of a protected subsystem.

In cases where there is not full isolation and changes must be made in a foreign object, a danger naturally arises of destroying data, so precautionary steps must be taken. The solution is to create an intermediary to which the source transmits the message, and from which the receiver takes it. A postal box (see Chapter 2) or other mechanism similar in idea may serve as such an intermediary. The intermediary must, for its part, be provided with means of security.

Thus we have described security mechanisms with different functional purposes and of different complexity and speed. As noted above, security questions are the subject of intensive work today and the growing complexity of systems and growing number of users with access to the system make the use of means of security inevitable.

BIBLIOGRAPHY

10-1. Feistel, H., "Cryptography and Computer Privacy," SCIENTIFIC AMERICAN, 1973, Vol 28, No 5, pp 15-23.

10-2. Shannon, C., "Raboty po Teorii Informatsii i Kibernetike" [Works on Information Theory and Cybernetics], Moscow, Mir, 1963, pp 333-402.

10-3. Feistel, H., Nonce, and Smith, "Cryptographic Methods in Machine Data Exchange," TIIER [Proceedings of the Institute of Electrical and Electronics Engineers], 1975, Vol 63, No 11, pp 10-21.

10-4. "Data Encryption Standard: Federal Information Processing Standard (FIPS), Publication 46," National Bureau of Standards, January 1977.

10-5. IBM SYSTEM JOURNAL, 1978, Vol 17, No 2.

10-6. Ehrsam, W. F., Matyas, S. M., Myer, C. H., and Tuckman, W. L., "A Cryptographic Key Management Scheme for Implementing the Data Encryption Standard," IBM SYSTEM JOURNAL, 1978, Vol 17, No 2, pp 106-125.

10-7. Diffie, W., and Hellmann, M. E., "New Directions in Cryptography," IEEE. TRANS. INFORM.THEORY, 1976, Vol IT-22, No 6, pp 644-654.

10-8. Merkle, R. C., "Secure Communications over Insecure Channels," COMMUNS. ACM, 1978, Vol 21, No 4, pp 294-299.

10-9. Rivest, R. L., Shamir, A., and Adleman, L., "A Method of Obtaining Digital Signatures and Public-Key Cryptosystems," COMMUNS. ACM, 1978, Vol 21, No 2, pp 120-126.

10-10. Soltzer, and Schroeder, "Information Security in Computer Systems," TIIER, 1975, Vol 63, No 9, pp 17-5.

10-11. Goldberg, R. P., "Architecture of Virtual Machines," in "1973 National Computer Conference Proceedings," Montvale, New Jersey, AFIPS Press, 1973, Vol 42, pp 309-318.

10-12. Popek, G. and Goldberg, R., "Formal Requirements for Virtualizable Third Generation Architectures," COMMUNS ACM, July 1974, pp 412-421.

10-13. Mednik, S., and Donovan, D., "Operatsionyye Sistemy" [Operating Systems], Moscow, Mir, 1978.

10-14. Fenstel, E. A., "On the Advantages of Tagged Architecture," IEEE. TRANS. COMPUT., 1973, Vol C-22, No 7, pp 644-656.

10-15. Diffie, W., and Hellmann, M. E., "Security and Resistance To Imitation: Introduction to Cryptography" TIIER, 1979, Vol 67, pp 71-109.

10-16. Tanebaum, E., "Mnogourovnevaya Organizatsiya EVM" [Multilevel Computer Organization], Moscow, Mir, 1979.

[112-11,176]

11,176
CSO: 1863

APPROVED FOR RELEASE: 2007/02/08: CIA-RDP82-00850R000300100055-7

OPERATING CAPABILITIES OF BASIC UNIFIED SYSTEM UNITS

Moscow MIKROPROTSESSORNYYE SISTEMY in Russian 1980 (signed to press 26 Jun 80) pp 50-51

[Excerpt of chapter 4 of book "Microprocessor Systems" by Iveri Varlmovich Prangishvili and Gennadiy Georgiyevich Stetsyura, Izdatel'stvo "Nauka", 9,750 copies, 240 pages]

[Excerpts] Let us look at Tables 4.3 and 4.4 which give the rates of data exchange necessary for the work of the most typical units of the YeS [Unified System] family. Only in the cases marked by an asterisk (*) is the required speed greater than the speed attainable with a telephone connection (line for byte-sequential, bit-parallel transmission).

Table 4.3. Speed of Certain Units of the Unified Computing System

Unit	Name	Transmission Speed, M bytes/sec
Alphanumeric Printer	YeS-7033	~ $3 \cdot 10^{-3}$
Magnetic Tape Store	YeS-5022 YeS-5010	0.126 0.064
Magnetic Disc Store	YeS-5051 (Capacity $1.25 \cdot 10^8$ bytes)	0.083
Magnetic Disc Store	*YeS-5056 (Capacity $7.25 \cdot 10^6$ bytes)	2.4
Magnetic Drum Store	YeS-5033 (Capacity 6 M bytes)	1.25
Multiplex Channel	YeS-1020 YeS-1050	0.0016 0.45
Selector Channel	YeS-1020 YeS-1050	0.3 1.25

Table 4.4. Time of Execution of Operations in the Unified Computing System

Type of Operation (word length — 4 bytes)	Name of Computer	Time of Execution, microseconds	Speed of Transmission Between Processor and Memory, M bytes, sec
Short	YeS-1020	20	≤ 1
	*YeS-1050	0.65	≤30
Addition-Subtraction with Floating Point	YeS-1020	50	≤ 0.4
	*YeS-1050	1.4	≤14
Main Memory Cycle	YeS-1020	2	2
	*YeS-1050	1.25	3.2

The capabilities of optical cable greatly exceed the requirements shown in Tables 4.3 and 4.4. This indicates that all the requirements of both microprocessor systems and conventional high-productivity systems for data exchange can be met with a simple data exchange subsystem structure if optical cables are used.

[112-11,176]

11,176
CSO: 1863

SOFTWARE

UDC 681.325.5-181.48:621.398

TOOLS FOR PROGRAMMING AND DEBUGGING K580 SERIES MICROPROCESSORS

Riga PROBLEMY SOZDANIYA, PROIZVODSTVA I PRIMENENIYA SREDSTV VYCHISLITEL'NOY TEKHNIKI NA OSNOVE MIKROPROTSESSOROV I DRUGIKH SOVREMENNYKH ELEMENTOV MIKROELEKTRONIKI in Russian 1980 pp 76-80

VASARIN'YEV, G. E., TISS, P. A., KHERMANS, M. K. and CHIPA, A. A.

[From REFERATIVNYY ZHURNAL: AVTOMATIKA, TELEMEKHANIKA I VYCHISLITEL'NAYA TEKHNIKA in Russian No 12, 1980 Abstract No 12A206 by A. M. Pshenichnikov]

[Text] The resident tools for debugging programs (P) are designed around the microprocessors of the given series and take the form of a microcomputer with a set of input-output facilities: a display or a typewriter, a punched card/tape input and output, etc. this microcomputer has a set of programs which make it possible to compile programs both for "itself" or for other small capacity controllers with an identical system of instructions. Depending on the assigned set of programs and the peripherals, resident systems are broken down into : 1) A monitor system; 2) A punched tape operating system; 3) A disk operating system. The monitor system requires a minimum amount of hardware for its realization and the least software. This system provides for control of the interfaced input-output peripherals and the debugging of programs in the machine language, and is applicable in practice to the debugging of small routines. Some 0.5 to 2 Kbytes of memory are sufficient for monitor system storage and it can be stored in the read only memory of low capacity microcontrollers. The punched tape operating system incorporates the monitor system and additionally has a text editor and compiler with a macroassembler. This makes it possible to write the programs in the symbolic Assembler language, and to obtain the program in the machine language by means of the compiler. The compilation and correction of the program in the Assembler language are accomplished by the test editor. This system requires a memory volume of about 16 Kbytes or more for its realization. It is convenient for the compilation of programs with lengths of from 1K to 4K bytes. The disk operating system is the most modern, however, it requires a memory volume of 32 Kbytes or more for its realization. But it nonetheless makes it possible to store both editing and compilation programs in the machine, as well as user programs, and thereby accelerate their debugging without loading the program from the outside by the operator. The sufficient memory volume in this system makes it possible to employ more complicated compilers and opens up possibilities for the compilation of programs in higher level languages such as PL or even FORTRAN. This system can also contain equipment and a set of routines which make it possible to speed up the debugging of the hardware of the microcontroller being created. This system can be expanded up to a real time operating system.

[91-8225]

MIKRAS SYSTEM OF MICROPROGRAMMING FOR MICROCOMPUTERS BUILT WITH THE SERIES K589 BASE

Tashkent ALGORITMY in Russian No 40, 1980 pp 9-11, 17

[Article by A. A. Bekasov, O. A. Nikulicheva and Yu. Ye. Sheynin; received by editorial board on 17 Dec 79]

[Excerpts] A substantial part of the outlays in developing microprocessing systems based on the series K589 microprocessor large-scale integrated circuits (BIS) [LSI] are outlays for compiling and debugging microprograms. The great labor-intensiveness of manual coding of microprograms, the large number of errors introduced in the process, and the high cost of making changes to microprograms written in PZU [read-only memory = ROM] lead to the necessity of creating facilities permitting automation of the microprogram development process.

One way of solving this problem is to develop a microprogramming language and realize the system of translation and fixation of codes in control memory.

The MIKRAS (microassembler) system is intended for microprogramming of computer hardware based on the series K589 microprocessor LSI circuits [1]. These microprocessor systems differ substantially from each other. Nevertheless, a substantial part of the functions for processing information and controlling the process of computations at the level of microinstructions is realized in such systems by the LSI circuits of the processor element (PE) and the microprogram control block (BMU) and is largely similar in the various systems. The microinstructions of these systems, as a rule, have separate fields that control these LSI circuits and have standard coding. This creates the prerequisites for constructing a language and microprogramming system adaptable to a specific application and invariant to the circuit of a specific processor.

Standard symbolic designations can be compared to fields of microinstructions that specify the microoperations of the microprogram control unit (MUU) and the processor element. For example, mnemonic designations of microoperations of the same type as that of symbolic designations of instructions in assembler languages are used in the CROMIS system [2]. In a microassembler language statement, this symbolic designation is specified for each microinstruction field, forming thereby in the statement a set of separate fields of operations (microoperations), the semantic link of which finds practically no reflection in the statement syntax. Microprocessing language terminology reflects not so much the operations being performed by the microinstruction as the control signals needed to execute them. Although the well chosen mnemonic of the individual microoperations may adequately reflect its meaning, it is not always easy to see what operations are being executed by the microinstruction as a whole from the set of microoperations listed in the microassembler statement.

To facilitate interpretation of written programs, in some microprogramming systems (for example, MICROBE [3]), comments are automatically generated to form an explanatory text in terms of the buses and registers and the operations on them. However, systems of this type do not help the developer at the microprogram compilation stage.

The MIKRAS system uses a different approach to enhancing the clarity of microprograms--specifying groups of microoperations by a single expression or syntactic construction in the source microprogramming language. Operations to be executed in the processor element LSI circuits are defined basically be three microinstruction fields: by a seven-bit processor element operation code field; by a microinstruction field controlling the feed of information to the input bus of mask K of the processor element LSI circuits; and by a field controlling the feed of the input carry signal C1 to the processor element LSI circuits. In the MIKRAS language, these operations are specified by a single formula that clearly represents the transformations being made and uniquely defines the codes of the indicated microinstruction fields. The overall form of the formulas (table) [not reproduced] is defined by the set of operations of the processor element LSI circuits and does not depend on the structure and system of microinstructions for a particular processor.

The MIKRAS system is realized on a microcomputer. It can operate both with external storage and just with perforated tape input-output devices. At least 16K bytes of storage are required to operate the system.

[125-8545]

8545
CSO: 1863

UDC 681.323:[62.001.63+681.5]

REZON: A SYSTEM FOR THE SOLUTION OF PLANNING AND CONTROL PROBLEMS. THE UNDERLYING CONCEPTS

Dimitrovgrad NAUCHNO-ISSLEDOVATEL'SKIY INSTITUT ATOMNYKH REAKTOROV. DIMITROVGRAD. PREPRINT in Russian No 17/425, 1980 pp 1-14

RUDKEVICH, A. V. ZAGATSKIY, B. A. and CHUPAKHIN, A. S.

[From REFERATIVNYY ZHURNAL: AVTOMATIKA, TELEMEKHANIKA I VYCHISLITEL'NAYA TEKHNIKA in Russian No 12, 1980 Abstract 12A527]

[Text] The REZON computer system is described, which consists of one or more computers, and is designed for the solution of a broad class of scientific, engineering and economic problems. A problem solution is found in the process of the asynchronous operation of several units, which operate with knowledge of the subject field of the system. A language for interacting with the system is presented, which is intended for the formulation of tasks of data storage and retrieval, as well as the execution of informational and computational processes. Tables 1; references 1.

[91-8225]

UDC 519.6:519.8

A METHOD OF OPTIMIZING THE PARAMETERS OF LARGE SCALE INTEGRATED CIRCUITS

Khar'kov SISTEMY UPRAVLENIYA LETATEL'NYKH APPARATOV in Russian No 5, 1979
pp 105-108

POPOV, V. A., MEZHOV, V. Ye. and SKIBENKO, I. T.

[From REFERATIVNYY ZHURNAL: AVTOMATIKA, TELEMEKHANIKA I VYCHISLITEL'NAYA TEKHNIKA in Russian No 12, 1980 Abstract No 12B100 by T. M. Kuznetsova]

[Text] An efficient algorithm for finding the extremum when solving the problem of the circuit planning for LSI's is treated. A modification of the method of projecting a vector-gradient is proposed, which employs a maximum optimality criterion in the optimization of the LSI parameters. A minimum operability margin serves as the target function; the target function is of a comb nature in the space of the controlled parameters. It is indicated that the proposed procedure for advancing to the optimum does not require the calculation of partial derivatives and therefore significantly curtails the requisite memory volume and increases the speed of the algorithm. Figures 1; references 9.

[91-8225]

UDC 681.322.067

THE DEVELOPMENT OF MACHINE FORMATS IN DATA BANKS AND CENTERS

Obninsk FIZICHESKIY ENERGETICHESKIY INSTITUTE. OBNINSK. PREPRINT in Russian
No OB-101, 1980 pp 1-35

SAL'NIKOVA, A. V. and KATAN, I. B.

[From REFERATIVNYY ZHURNAL: AVTOMATIKA, TELEMEKHANIKA I VYCHISLITEL'NAYA TEKHNIKA in Russian No 12, 1980 Abstract No 12B161]

[Text] An analysis of the scientific and technical literature on the question of the organization of information retrieval systems in data libraries and centers and the development of the input formats is given in this review. The format used in the center being created for data on heat exchange and hydrodynamics is briefly described. It is shown that the format being used is universal to a considerable extent and can be used practically without changes in a number of related scientific fields.

[91-8225]

UDC 681.322.067

EXPERIENCE WITH THE DESIGN OF THE AUTOMATED INFORMATION AND REFERENCE SYSTEM IN THE INSTITUTE OF ELECTRONICS OF THE UZBEK SSR ACADEMY OF SCIENCES

Perm' INFORMATSIONNYYE SOOBSHCHENIYA AN UZSSR in Russian No 242, 1980 pp 3-16

ARIFOV, P. U., KULAGINA, A. D., MAL'YAN, V. M. and UMAROVA, F. T.

[From REFERATIVNYY ZHURNAL: AVTOMATIKA, TELEMEKHANIKA I VYCHISLITEL'NAYA TEKHNIKA in Russian No 12, 1980 Abstract No 12B163 by T. M. Kuznetsova]

[Text] The "IPS-Elektronika" information retrieval and reference system created at the Institute of Electronics of the Uzbek SSR Academy of Sciences in conjunction with the Scientific Research Institute for Control Machines and Systems (NIIUMS, Perm') is described. The reference system consists of three subsystems: data collection, processing, input and storage; selective (differentiated) information dissemination; retrospective (reference) information retrieval. Information retrieval languages for the machine formalization of the process of interacting with the system, retrieval forms of documents and queries, grammatical tools for the information retrieval languages as well as a descriptor dictionary and thesaurus are treated. The criterion for the correspondence of meaning is formulated, in accordance with which the copies of documents stored in the computer are fed out in replay to information queries; formulas are given for the retrieval completeness and precision which serve as indicators of the efficiency of the information retrieval system. The results of the introduction of the automated "Execution Monitoring" system for the distributional activity of the Presidium of the USSR Academy of Sciences and the IPS-1 [information retrieval system 1] system are presented. A report is made on the development of the "IPS-Patent" [patent information retrieval system] subsection.

[91-8225]

UDC 681.3.06

EXPERIMENT IN TRANSFERRING PROGRAMS IN THE ASSEMBLER LANGUAGE FROM THE BESM-6 TO THE YeS COMPUTER

Moscow VESTNIK MOSKOVSKOGO UNIVERSITETA, SERIYA 15: VYCHISLITEL'NAYA MATEMATIKA I KIBERNETIKA in Russian No 4, 1980 pp 62-66

[Article by V. A. Kozub and R. L. Smelyanskiy]

[Excerpts] The problem of transferring programs in low-level programming languages from the Madlen autocode (BESM-6) to the assembler language (YeS-1022) is examined in the article. It should be noted that the transfer of programs in the assembler language is more complex, as in that case distinctive features of a specific machine are used maximally. One of the first practical works in that direction evidently is [1], where an experiment in the transfer of programs from the IBM 7090 assembler language to the IBM 7040 assembler language is described. In that case, however, a more complex problem is examined, as the architecture of the initial (BESM-6) and target (YeS-1022) computers is essentially different.

Various ways and means of transfer have been developed by now [2,3]. In the present work an analysis is made of a method in which the program to be transferred (a Madlen program) is pre-processed for the BESM-6 and finally for the YeS-1022. The realization of that method consists in a system of two macroprocessors. The first macroprocessor, the initial text for which is the text of a program in Madlen autocode, transforms each instruction of the Madlen program for the BESM-6 into the format of assembler instructions of the YeS computer, and also performs some transformations of the address part of the instructions. Its output text serves as a source text for a second macroprocessor, a YeS computer macrogenerator, on the outlet of which the text of programs is obtained in the YeS computer assembler language. Commentary-instructions are not implemented by the first macroprocessor, but are transferred to output text. The instructions for assignment of constants undergo special processing.

Each instruction of the Madlen autocode is described in the YeS computer assembler language in the form of a microdefinition. The macrodefinitions were composed in such a way that they simulate in a programmed manner those distinctive features of the Madlen autocode instructions list which on the BESM-6 are assured by the apparatus.

Time expenditures on the development of the system are estimated to be approximately 3 man-months. The volume of realization of the first macroprocessor for the BESM-6 is equal to about 1000 Madlen autocode operators; the volume of microdetermination texts for the YeS computer macrogenerator is about 1500 assembler instructions. Of course, certain efforts will be required to complete the variant of the system available at the present time.

[69A-2174]

2174
CSO: 1863

NEW BOOK ON AUTOMATED PRODUCTION CONTROL SYSTEMS USING APPLIED PROGRAM PACKETS

Moscow VNEDRENIYE AVTOMATIZIROVANNOY SISTEMY UPRAVLENIYA PROIZVODSTVOM NA BAZE PAKETOV PRIKLADNYKH PROGRAMM in Russian 1980 (signed to press 1 Aug 80) pp 2-4, 16, 136

[Annotation, excerpts and table of contents from book "The Introduction of an Automated Production Control System Based on Applied Program Packets", by Eduard Mikhaylovich Benetskiy, German Aleksandrovich Morozov, Leonard Alekseyevich Obolenskiy and Vladimir Andreyevich Chernoivanov, Izdatel'stvo "Statistika", 20,000 copies, 136 pages]

[Text] Experience with the introduction and operation of automated control systems at an interprise with small series and series type production based on packets of applied programs, incorporated in the informatior system for production control (ISUP) is presented in the book.

It is intended for users introducing packets of applied programs as well as specialists engaged in the development and introduction of automated production control systems based on the unified system of computers.

Introduction

Under the conditions of developed socialism, the problems of refining the control of industrial production are becoming even more urgent because of the increase in the scales of production and the trends towards its intensification based on the latest achievements of science and engineering.

A major step in the realization of the basic ways of improving the management mechanism, established by the 25th CPSU Congress, was the decree of the Cental Committee of the CPSU and the USSR Council of Ministers "On Improving the Planning and Strengthening the Efficacy of the Management Mechanism to Increase Production Efficiency and Work Quality."

The technical retrofitting of industry has necessitated changes in the organization of management and the development of new control methods for production processes. The brigade method of labor organization, approved by the Central Committee of the CPSU and recommended for application in industry, has become widespread.

In their development, automated control systems have moved from the solution of individual local bookkeeping tasks on first generation computers to the design of integrated organizational and technological systems based on third generation computers.

It is well known that the major task of production control is the determination of which product is to be produced at what time, in which amount and with what breakdown, i.e., the work schedule chart is to be drawn up in a definite sequence. This chart should be monitored, and in the case of deviations from the planned production course, organizational and technical measures should be taken to assure its implementation or correction.

The design of an AUS set up for local tasks does not permit the solution of this problem, since in production, processes are interrelated and require an integrated solution.

In the development of the new problem oriented software for the YeS EVM [unified system of computers] - packets of the applied programs "production control information system" (PPP ISUP) - the prerequisites exist for the creation of qualitatively new ASU's, as well as for a change in the technology planning and introducing ASU's into industrial service.

The opinion exists that there are no two identical control systems for machine making enterprises. The difference is determined, on one hand, by the production technology, and on the other, by the role of the supervisory staff in managing the enterprise. However, it can be asserted that the same problem is being solved at all machine making enterprises, with all of their individuality: the determination of the work sequence to provide for the production of the goods to be marketed in the planned timeframes. These same tasks are realized by the PPP ISUP [packets of applied programs for the production control information system]. The PPP ISUP's have been treated in detail in [11-14]. The material and information flows of a generalized enterprise, as well as the composition and characteristics of the PPP ISUP are briefly treated in the literature. One of the control concepts for a machine making enterprise is set forth in more detail. This concept was developed by specialists of the GNIPI-VT (Kazan'), the Kaliningrad affiliate of the "Soyuzgazavtomatika" special design office of the Ministry of the Gas Industry and has passed practical testing at the Kaliningrad Experimental Plant of the "Soyuzgazavtomatika" All-Union Scientific Production Association Ministry of the Gas Industry.

The design principles for data banks studied in this paper as well as the technology for their construction and operation can be used in numerous machine making enterprises where the volume of the information base runs up to 100,000 objects.

The proposals for the determination of the generation parameters, the training of administrative personnel as well as the organization and implementation of ASU's based on PPP ISUP's should be treated as one of the possible variants which was produced by a trial and error method during the design of the ASU at the

Kaliningrad Experimental Plant of the "Soyuzgazavtomatika" All-Union Scientific Production Association of the Ministry of the Gas INdustry.

2.1. The Composition of the Software

The software of the production control information system is based on packets of applied programs (PPP), which function using a single information base designed on the principle of a SIOD [integrated data processing system] data bank (BD).

A brief description of the functional packets of the applied programs of the ISUP [production control information system] is given in this chapter.

At the present time, considerable literature has been published on ISUP applied program packages, for example [1, 4], in which the functional capabilities. the purpose and recommendations for the determination of generation parameters and the description of the routines are treated in sufficient detail.

The authors of this book considered it necessary to provide only a brief description of them for those readers who are becoming acquainted for the first time with the ISUP packets of applied programs and their application to the design of ASUP's [automated production control systems].

Functional flowcharts of the PPP ISUP's developed by the Leningrad Institute for the Improvement of Municipal Management and Industrial Workers' Skills Using Management Techniques and Tools (LIMTU) are shown in Figures 2.1-2.5 [not reproduced] in this chapter.

The following are incorporated in the functional packets of applied programs:

The "stock management" (UZ) PPP;
The "demand planning" (PP) PPP;
The "capacity planning" (PM) PPP;
The "shop control" (UTs) PPP;
The "data base servicing system" (SOIB) PPP;
The "design of standard setting calculations" (RNK) PPP;
The "complex for the operational accounting for monthly output and reports on a shop by shop basis" (KOUVOTs) PPP.

All of the applied program packets function only on the basis of the PPP of the SIOD.

Table of Contents

[121-8225]

8225
CSO: 1863

ORGANIZATION OF ASU PROGRAM PRODUCTION AND REALIZATION

Moscow ORGANIZATSIYA SOPROVOZHDENIYA PROGRAMMNYKH SREDSTV ASU in Russian 1980 signed to press 21 Apr 80 pp 9-10, 13, 21, 27, 29-30, 60-61

[Annotation, table of contents and exerpts from the book by Vladimir Pavlovich Tikhomirov, Izdatel'stvo "Statistika", 17,000 copies, 64 pages]

[Text] The brochure is devoted to questions regarding the organization of program production and realization. Such methodological questions as centralized program production and realization and the organization of work on them are examined. Special attention is given to work on making up specialized algorithm and program funds of ASU's and a procedure for estimating the economic effect of the application of software in ASU's.

The brochure is intended for specialists developing ASU's and also for graduate and undergraduate students of VUZ's with the corresponding specialties.

Contents — Page

Chapter 1. Methodological Questions Regarding the Organization of ASU Program Production and Realization

1.1. The Information Industry--a New Sector of Material Production

[Excerpt] In the Soviet Union specialized scientific research institutes and design offices are engaged in the development of applied programs for various purposes, including for application in automated control systems. The task of the "Tsentro-programmsistem" Scientific and Production Association includes the development of standard programs, management of the ASU specialized algorithm and program fund and the provision of users and ASU developers with programs from the fund. Included in the fund are packages of applied programs developed both by the "Tsentro-programmsistem" Scientific and Production Association and by other organizations of the country regardless of the department they belong to.

For the further development of work in the area of software the USSR State Committee for Science and Technology approved the program of work for 1978-1980 on the creation of standard applied programs for mass application, in which the development and transfer to the fund of the "Tsentroprogrammsistem" Scientific and Production Association of over 100 packages of applied programs is envisaged.

In addition, a large number of measures is being accomplished in the country on the creation of the system of organizations of the State Algorithm and Program Fund. The system includes a large number of organizations managing sector and centralized algorithm and program funds for automated systems for the management of enterprises, associations and organizations in all sectors of the national economy, and also for automated systems for control of technological processes and scientific research and developments.

1.2. Computer Program Production and Realization as a Stage in the Development of ASU Software

[Excerpt] YeS computer software includes the YeS OS and YeS DOS operating systems. Those operating systems can be used for any of those models, but they have different efficiency, which depends on the computing capacity of the installation and the areas of application. As a rule, the YeS DOS assures greatest efficiency on smaller models with a small main storage volume, and the YeS OS is most efficient on larger models.

1.3. Centralized ASU Program Production and Realization

[Excerpt] The Central Computer Program Fund is managed by the All-Union Scientific and Technical Information Center under the USSR State Committee for Science and Technology. The specialized and sector program funds are managed by organizations (enterprises) designated and approved by the management of the corresponding ministries and departments. Inter-sector directions of centralized program production and realization are assigned and attached to specific organizations:

--versions of operating systems and program facilities which expand the possibilities of YeS computer operating systems--as a specialized algorithm and program fund;

--program facilities for solving problems of automated control systems for a sector of industry or for non-industrial objects and automated enterprise management systems--as a specialized algorithm and program fund at the "Tsentrprogrammsistem" Scientific and Production Association of the USSR Ministry of Instrument-Making, Means of Automation and Control Systems;

--program facilities for solving problems of automated control systems for the control of technological processes--as a specialized algorith and program fund under the Kiev Planning and Design Office of ASU's of the USSR Ministry of Instrument-Making, Means of Automation and Control Systems:

--program facilities for automated construction control systems and automated design systems for objects of construction--as a specialized algorith and program fund under the Central Scientific Research and Planning and Experimental Institute of of Automation of Systems in Construction of the USSR Gosstroy.

Special structural subdivisions are being created in each organization to work on centralized production and realization of program facilities (fund maintenance activity).

Fund maintenance activity is planned, financed and provided for by corresponding stores and resources.

The State Algorithm and Program Fund functions on the basis of contractual relations, khozraschet, planning and contractual discipline, and the property responsibility of organizations which maintain funds.

1.4. Organization of Work on Centralized ASU Program Production and Realization in the "Tsentrprogrammsistem" Scientific and Production Association

[Excerpt] On 1 January 1980 the ASU Special Algorithm and Program Fund included 207 standard program facilities which permit creating programs for automated systems for management of enterprises and organizations of different levels of administration and sectors of the national economy. Participating in making up the fund are 40 organizations of various ministries and departments, and also organizations of CEMA member-countries within the framework of realization of the Unified Coordination Plan of the Intergovernmental Commission on Collaboration of the Socialist Countries in the Area of Computer Technology.

The creation of the ASU Specialized Algorithm and Program Fund and the provision of users with programs are being accomplished on the following scales:

Year	Fund volume: Number of packages	Fund volume: Number of machine instructions, 1000 instructions	Number of ASU SFAP user-organizations
1974	11	408	42
1975	34	2057	228
1976	64	2909	354
1977	104	4300	546
1978	150	6500	600
1979	173	6300	700

Users' specialists are taught in the course system in the form of lectures and practical assignments (solution of training problems on a computer, with subsequent analysis). The training program is being developed by specialists of "Tsentrprogrammsistem" Scientific and Production Association.

All the work done by the association is in accordance with bilateral agreements.

In the course of 1978 the "Tsentrprogrammsistem" Scientific and Production Association delivered more than 2000 program facilities at the orders of 600 organizations of the country. Over 1000 specialists of user organizations underwent instructions in the association in working on the application of program facilities in an ASU.

The realization of progressive methods and control algorithms in packages of applied programs elevates the scientific and technical level of ASU's, and consequently the effectiveness of their functioning.

However, the degree to which sectors of the national economy are provided with programs by the ASU Specialized Algorithm and Program Fund oriented toward third-generation computers amounted to about 29 percent in 1978.

[88-2174]

2174
CSO: 1863

APPLICATIONS

PATTERN RECOGNITION RESEARCH ORGANIZATIONS

Moscow SOVREMENNYYE PROBLEMY KIBERNETIKI in Russian 1980 pp 6-7

[Foreword by Yu. I. Zhuravlev, Lenin Prize laureate, professor, doctor of physical and mathematical sciences, and I. B. Gurevich, candidate of physical and mathematical sciences]

[Excerpt] In the Soviet Union work on pattern recognition has been done since about the mid-1950's, and since the end of the 1960's and during the course of all the 1970's a constant acceleration of the development of that direction and an intensive expansion of applications have been observed. A number of completely original methods of recognition have been proposed and developed, within the framework of which important theoretical results have been obtained (as examples one can cite an algebraic approach to recognition, the method of potential functions, the method of heuristic self-organization and the restoration of dependences from small samples); several packages of recognition programs have been produced. The application of recognition has become ordinary practice in geology, medicine and sociology, the number of applications of recognition in industry is growing, and there have been the first attempts to use recognition in agriculture. A number of scientific research teams have been formed and are actively growing in the area of recognition. Very great attention is being given to recognition in such major scientific research centers as the Institute of Cybernetics of the Ukrainian SSR Academy of Sciences, in Kiev (V. I. Vasil'yev, industrial applications; A. G. Ivakhnenko, a method of group argument recording, heuristic self-organization, perceptrons; V. A. Kovalevskiy, G. L. Gimel'farb, V. I. Rybak and M. I. Shlezinger, statistical recognition, pattern recognition, the syntactical approach); the Computer Center of the USSR Academy of Sciences, in Moscow (Yu. I. Zhuravlev, an algebraic approach, algorithms for estimate calculation, combinatory-logical methods); the Institute of Mathematics, Siberian Department, USSR Academy of Sciences, in Novosibirsk (N. G. Zagoruyko, empirical prediction, taxonomy); the Institute of Control Problems of the USSR State Committee of the USSR Council of Ministers and the USSR Academy of Sciences, in Moscow (M. A. Auzerman, E. M. Braverman and L. I. Rozonoer, the method of potential functions; N. V. Zavalishin and I. B. Muchnik, visual image recognition; V. N. Vapnik and A. Ya. Chervonenkis, restoration of dependences from small samples; Ya. Z. Tsypkin, teaching theory); Institute of Problems of Information Transmission of the USSR Academy of Sciences, in Moscow (I. Sh. Pineker, recognition and description of images constructed of lines; statistical recognition); the Institute of Technical Cybernetics of the Belorussian SSR Academy of Sciences, in Minsk (automation of design processes); the Institute of Electronics and Computer Technology of the Latvian SSR Academy of Sciences, in Riga (L. A. Rastrigin, collective decisive rules, theory of random search); the Institute of Cybernetics of the Uzbek SSR Academy of Sciences, in Tashkent (applied programs).

A similar situation of intensive research and development is also observed in the area of man-computer interaction systems. Here one should not above all the work being cone in the Computer Center of the USSR Academy of Sciences (Moscow), the Computer Center of the Siberian Department, USSR Academy of Sciences (Novosibirsk) and in the Faculty of Psychology of Moscow State University Imeni M. V. Lomonosov (Moscow).

[88-2174]

2174
CSO: 1863

UDC 681.3

DESCRIPTION OF NEW M-60 COMPUTING SYSTEM FOR INDUSTRIAL PROCESSES

Moscow PRIBORY I SISTEMY UPRAVLENIYA in Russian No 12, Dec 80 pp 2-4

[Article by D. A. Todau, candidate of technical sciences and deputy general director of the Tbilisi Elva Science-Production Association, and engineers U. N. Devdariani, V. M. Zav'yalov, T. M. Banzeladze, A. D. Khurtsidze, A. N. Gegamov, and N. A. Barbakadze: "The M-60 Information Complex"]

[Excerpts] Building automated control systems for complex industrial processes involves solving a number of problems related to the development of measuring and computing equipment for collection and primary processing of data from the sensing units of the object, feeding this data to the computer, monitoring the state of the industrial process, representing this information to the industrial operator, and so on. This set of equipment must meet a number of specific requirements. The basic requirements result from the necessity of collecting and processing a large volume of information (2,000 points and more), insuring high reliability in performance of primary functions, minimizing time required to feed measurements to the computer, autonomous functioning (when the computer malfunctions), and monitoring the working condition of the equipment itself.

Taking these requirements into account the Tbilisi Scientific Research Institute of Instrument Making and Automation Equipment of the Tbilisi Elva Science-Production Association developed the model M-60 for use in automated control systems for complex industrial processes at facilities such as large power generating units, chemical production sites, and so on. This article describes the model M-60 and the working principles of its units, as well as the features of its structural assembly, software for interaction with computing complexes, and basic technical specifications.

Make-Up and Designation of the Units of Model M-60

The Model M-60 (see Figure 1 [not reproduced]) includes the following units:

- switching, normalization, and conversion (UKNP), which switches signals from analog sensing units, normalizes, filters, amplifies, and performs analog-digital conversions of signals with output of the measurements in both analog and discrete forms;

- switching discrete sensing units (UKDD), designated to collect information from discrete sensors of the de-energized ("dry") contact type;

- control of the information complex (UUIK), which organizes data exchange between units of the Model M-60, scales information coming from the UKNP, and linearizes nonlinearities in the sensing unit responses;

- identifying and storing deviations (UVPO), which monitors technological parameters by comparison with a physical model of the object and then outputs deviation signals to the control console, to the computing complex, and to the register unit;

- digital monitoring and graphic registration (UTsKGR), which organizes the output of measured and calculated parameters to digital devices (TsP) and graphic registers (GR) at the operator's command;

- registration with address-assigning principle of printing (RUAP), which registers the measured and calculated parameters in a digital printer and also registers parameters that deviate from the norm;

- communications (US) which has linkages with the computing complex (USVK) and data branching linkages (URD) which provide information exchange between the units of the Model M-60 and the computing complex;

- control console of the information complex (PIK) for monitoring the functioning of the Model M-60 and diagnosing malfunctions in the units.

Operating Principles of the Units of the Model M-60

Figure 2 [not reproduced] shows a schematic diagram of the Model M-60 and its linkages with a M-6000 computing complex.

All the programs are written in the MNEMOKOD language in the form of replaceable modules with due regard for the processors used in the computing complex and operations system. The drivers in each operations system have a standard structure, service requests formulated as standard inquiries, support interactions with existing programs and elements of the operations system in an established manner, and broaden the potential use of the Model M-60 by providing for additional functions. These additional functions include cyclical and irregular queries of the sensors, monitoring the working condition of the equipment, switching particular programs in and out, and so on.

Basic Technical Description of the Model M-60

Number of:	
Analog Sensing Units Connected	up to 3,968
Discrete Sensing Units Connected to One UKDD	up to 2,048
Analog Sensing Units Connected to One UKNP	up to 256
Analog Indicating Devices (Type PPM-2) Connected to One UKNP	up to 24
Digital Devices and Graphic Registers Connected to One UTsKGR (in any combination)	up to 8
Parameters Monitored by One UVPO	up to 512
Parameters Registered Simultaneously on the RUAP (in assignment of random addresses mode)	up to 24
Units Connected to Communications Unit	up to 32
RUAP and UTsKGR served by one UUIK	up to 11
UKNP's Connected to the UUIK	up to 16

The table below indicates the error of the measurement channels. The information and design compatability of the units of the Model M-60, the possibility of communications between it and the computing complex through a standardized 2K interface, the aggregate principle of construction, the flexibility of the interrelationships among units, the characteristics of structural arrangements that have been noted, and autonomous functioning are all features that make it possible to use the Model M-60 as part of various automated control systems for industrial processes that differ by volume of information being processed, set of functions performed, and the level of reliability and efficiency.

Maximum Allowable Calculated Basic Error for a Circuit

Type of Sensing Unit	Digital (%) A. Systematic	Digital (%) B. Random	Analog (%)
Thermal Electric Thermometers	±0.25	0.15	±1.5
Resistance Thermometers	±0.15	0.15	±1.2
Low Level Signal Sensing Units:			
0-10 mv	±0.25	0.15	±1.5
0-20 mv	±0.25	0.15	±1.5
0-50 mv	±0.15	0.15	±1.2
0-100 mv	±0.15	0.15	±1.2
Rheostat Sensors	±0.1	0.1	±1.2
Sensors of Standardized Current Signals of 0-5 ma	±0.1	0.1	±1.2

Key: (A) Systematic Component in Percentage;
(B) Mean Quadratic Deviation of Random Component in Percentage.

At the present time the Model M-60 is being produced in series by the experimental General-Purpose Computer Plant of the Tbilisi Elva Science-Production Association. The first models have been installed at the Reftinskaya State Regional Power Plant, the Beloyarskaya and Novovoronezhskaya Atomic Power Plant, and elsewhere.

[87-11,176]

11,176
CSO:1863

UDC 681.3.06:51

QUESTIONS RELATING TO PROGRAMMING SIMULATION PROBLEMS ON THE M-10 SYNCHRONOUS MULTIPROCESSOR COMPUTER

Moscow PROGRAMMIROVANIYE in Russian No 6, 1980 pp 37-45 manuscript received 10 Jun 79, after correction 21 Jan 80

[Article by M.A. Berezovskiy, M.F. Ivanov, I.V. Petrov and V.F. Shvets]

[Text] This article is devoted to questions relating to the development of a multiprocessing system for the simulation of multidimensional physical processes on an M-10 synchronous multiprocessor computer. A computing model of plasma kinetics based on the method of macroparticles is discussed. Methods of multiprocessing are described for simulation steps and for input/output coordinated in terms of speed with simulation computations.

At the present time a great amount of favorable experience has been gained in the simulation of physical processes on a computer. But a great deal of the successes achieved relate to unidimensional problems, since the capacity of the computing system used is insufficient for the simulation of problems of greater dimensionality. An especially acute need for new types of computers has originated in connection with solving multidimensional problems of hydrodynamics and plasma kinetics, which are important for research in the area of thermonuclear synthesis, plasma physics and high-temperature hydrodynamics.

In this study a procedure is described for using the M-10 synchronous multiprocessor computer for solving complicated problems, with the simulation of plasma kinetics as an example.

The M-10 Computer and Some Methods of Programming on It

The M-10 [1] is a synchronous multiprocessor computer in the sense that its structure includes a number of different types of processors which can operate in parallel (synchronously), i.e., during a single machine cycle in each processor an operation of this processor can be begun and concluded. For the purpose of implementing this method of functioning in a program, an M-10 machine instruction contains a list of operations for processors which are to be initiated in a specific cycle. Practically all control and arithmetic operations are executed during a single machine cycle (1.8 μs).

The structure of the M-10 computer contains the following types of processors:

The first type is represented by arithmetic processors which are implemented physically as two independent arithmetic units synchronously executing various arithmetic or logic operations. Each unit can be represented by one, two, four or eight processors, depending on the word length of input operands specified in the arithmetic operation. From the viewpoint of the programmer, in each program step can be brought into play two 128-bit processors, four 64-bit, eight 32-bit or 16 16-bit, whereby each processor can perform a two-place operation on operands of the word length indicated. In this sense it is possible to speak of the presence in an M-10 computer of a vector, of length N (N = 2, 4, 8, 16) , of arithmetic processors synchronously processing N flows of data with a word length of 128, 64, 32 and 16, respectively.

The system of operations includes a complete standard set of arithmetic and logic operations on numbers with a fixed and floating point, as well as such complex operations as the scalar multiplication of two vectors, the integration of a function (continuous summation), etc.

An important distinctive feature of the functioning of the vector of arithmetic processors consists in the ability to operate by a mask. For this purpose to each processor is connected a certain flip-flop in which the "1" permits the execution of an operation in this processor, and the "0" prohibits it. The combination of these flip-flops forms a mask register the data source for which can be a memory or a register of indicators of the results of operations to be worked on by the vector of processors.

The second type of processor, operating in synchronism with arithmetic processors, is the control unit. The control unit makes possible the full abundance of register arithmetic operations and logic operations on the mask register, as well as transfer operations, the organization of cycles, etc.

To the third type of processor belong two synchronously operating processor-memory communication channels, designed for reading out operands from the memory into the input registers of the arithmetic processors and for recording the results of operations. The maximum width of access to the memory for each channel equals 512 bits, which makes it possible to fill the input registers of all arithmetic processors with a single access with the serial storage of these bits in the memory, e.g., for eight processors can be read eight pairs of operands of 32 bits each.

Access to the memory is accomplished through a virtual address with the format "index, base, shift." The word length of a shift is 22 bits and the minimum addressable memory element is a half-word (16 bits). The internal storage with a total capacity of five megabytes is divided into two levels and the rate of exchange between levels is 20 megabytes per second.

The fourth type of processor is a multiplex channel for direct access to the internal storage, making it possible to accomplish input/output through 24 duplex subchannels with a total speed of seven megabytes per second. To each subchannel can be connected up to six external units of the same type.

The structure of the M-10 computer makes possible two major types of multiprocessing of algorithms: first, with N identical arithmetic processors synchronously performing the same operation and, second, with different types of processors (physical units) operating in parallel, including two arithmetic units, two processor-memory channels, a control unit and a multiplex channel.

Methods of producing parallelism of the second type are called asynchronous and have been studied comparatively well, unlike methods of the first type--synchronous. Statistical data make it possible to rate the speed of the M-10 at approximately five million operations per second with the successful application of both types of multiprocessing methods.

Obviously there are a great number of problems which have natural parallelism, characteristic of which is good agreement between the algorithm and structure of the data on the one hand and the structure of the computer on the other. This study elucidates some questions relating to multiprocessing for a specific class of applied algorithms having natural synchronous parallelism.

Let us discuss a class of algorithms possessing the property that a specific number of identical branches has been distinctly isolated in them, the order of the execution of which is indifferent. Characteristic of these algorithms is the existence of a certain number of sets of data of an identical structure which can be processed by the same algorithm the procedure for the execution of which does not depend on the specific values of the data in each set. Let us note that in this case on a vector computer is run an ordinary "serial" algorithm.[1] Below we will call an algorithm possessing this property a linear algorithm.

Let $P = \{p_1, p_2, \ldots, p_l\}$ represent the set of data for a linear algorithm. Let us assume that the problem requires that data sets $P^1, P^2, \ldots, P^n$ be processed according to this algorithm. Then it is possible to start the same "serial" algorithm in all processors operating in parallel, so that each processor will process its own set of data. Here the data must be allocated in the computer's memory in such a manner that access to it can occur in parallel with computations.

Let the number of processors operating in parallel equal N. Let us allocate the data in the following manner:

$$\begin{array}{l} p_1^1,\ p_1^2,\ \ldots,\ p_1^N, \\ p_2^1,\ p_2^2,\ \ldots,\ p_2^N, \\ \cdots\cdots\cdots \\ p_l^1,\ p_l^2,\ \ldots,\ p_l^N, \\ p_1^{N+1},\ p_1^{N+2},\ \ldots,\ p_1^{2N}, \\ \cdots\cdots\cdots\cdots \\ \cdots\cdots\cdots\cdots\ p_l^r \end{array} \qquad (1)$$

Here the subscript is the index for an element within a set and the superscript is the index of the set. This data structure is entered in the memory serially line by line, and each line is processed in parallel by N processors.

With this structure, taking into account the width of access of memory access channels and the linearity of the algorithm, the problem makes possible N-fold multiprocessing for N flows of data (the columns of matrix (1)) at all steps, beginning with the reading out of data and ending with the recording of results in the memory. For processing all data, if n is a multiple of N, are required approximately n/N repetitions of the algorithm.

If by virtue of the specifics of the problem it is impossible to order the data beforehand in the manner described above, then with the presence in the computer of special hardware for editing data arrays it is necessary to order the data in the proper manner each time before access to the memory.

The computer modification used does not have hardware for editing data arrays, but the presence of two independent processor-memory channels operating in parallel in this situation makes possible multiprocessing of the problem to no less an extent than with two flows of data.

Computational Length of the Problem

The plasma kinetics simulation problem is formulated in the following manner [3]: Under discussion is a collision-free nonrelativistic model of a plasma taking into account the self-consistent electric and external variable electric and magnetic fields in space (x, y, v_x, v_y, v_z), based on the system of Maxwell-Vlasov equations. For the purpose of numerical simulation was selected the method of macroparticles [4], which is sufficiently optimal in terms of expenditures of computing resources and simulation accuracy. Simulation is divided into the following three steps:

1. Start--the initial distribution of macroparticles in the phase space.

2. Calculation of the self-consistent electric field at the points of a rectangular regular net in space (x, y) by solving the appropriate Maxwell equation in the net by employing a rapid Fourier transform (BPF).

3. Permutation of all macroparticles in the phase space under the effect of electric and magnetic fields and determination by the employment of simple interpolation formulas of the charge density at points of the net relative to the position of macroparticles.

The first step, which is performed once during a simulation session, contains no more than approximately 10^8 machine operations and therefore does not make an important contribution to the length of the session. Steps 2 and 3 are performed on the order of 10^3 times (time intervals), which is sufficient for solving physics problems.

The internal simulation cycle--step 3-- contains M repetitions, where M represents the total number of macroparticles in the computing model. For the purpose of achieving sufficiently high simulation accuracy, M was chosen to be approximately 10^6, and the dimensionality of the net 64 X 64.

In this case the computational length of the problem consists of approximately $10^3 L_E + 10^9 L_I$ machine operations, where L_E is the number of operations in the step of computing the field in terms of an assigned charge density and L_I is the number of operations included in the internal cycle.

Number L_E contains (according to known estimates of the efficiency of a BPF [5]) at least approximately $15 \cdot 64^2 \cdot \log_2 64^2 \approx 0.75 \cdot 10^6$ machine operations, taking into account the need to perform direct and inverse transformations, so that during the entire simulation session computation of the field requires approximately $0.75 \cdot 10^9$ operations, which is obviously considerably less than the computational le th added by the internal cycle.

Test programming on a BESM-6 computer demonstrated that $L_I \sim 500$ machine operations.[2] Therefore, the computational length of the problem equals at least approximately $0.5 \cdot 10^{12}$ operations, which requires approximately 300 h of continuous calculation on a BESM-6, taking into account the specific structure of internal cycle program steps.

It should also be noted that the volume of memory occupied by the problem's data (the set of macroparticles) is also quite great. For each of the approximately 10^6 macroparticles it is necessary to store at a minimum two coordinate components and three velocity components, each with a length of not less than 32 bits, in order to achieve the required accuracy. Thus, the volume of memory required equals approximately 20 megabytes. Therefore, the data must be placed in external storage (e.g., on magnetic disks (MD's)), which entails the appearance of delays in the simulation process occasioned by the slowness of input/output units. These delays can worsen the time characteristics of the problem even more if special measures are not taken.

Clearly the time and memory estimates presented are unacceptable for the majority of modern domestic computers. On the other hand, the employment of a computer with an untraditional architecture appropriate to the method of solving the problem makes it possible to speed up the simulation process by more than an order of magnitude, which will be demonstrated below.

Implementation of Basic Steps in Simulation

The majority of algorithms making up the computing model are linear. For the purpose of providing the possibility of access to the memory in parallel with computation, the data have the following structure:

$$x_{11}, x_{21} \ldots x_{N1}, y_{11}, y_{21} \ldots y_{N1}, u_{11}, u_{21} \ldots u_{N1}, v_{11}, v_{21} \ldots v_{N1},$$
$$w_{11}, w_{21} \ldots w_{N1}$$
$$\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots$$
$$x_{1s}, x_{2s} \ldots x_{Ns}, y_{1s}, y_{2s} \ldots y_{Ns}, u_{1s}, u_{2s} \ldots u_{Ns}, v_{1s}, v_{2s} \ldots$$
$$\ldots v_{Ns}, w_{Ns}, w_{1s}, w_{2s} \ldots w_{Ns},$$

where x and y represent the coordinates and u , v and w the speeds of a particle in the direction of x , y and z , respectively; N is the number of synchronously operating processors; S is the number of repetitions of the internal cycle necessary for processing M particles taking multiprocessing into account; and $M = NS$ is the total number of particles in the problem. In writing a_{jk} $(a \in \{x, y, u, v, w\})$, subscript j is the number of the processor in which quantity a_{jk} is processed, and subscript k is the number of the portion in which quantity a_{jk} is processed.

This distribution of particle parameters in the memory is achieved if computations in the start step are organized in the following manner: The j-th processor, where $j = 1, 2, \ldots, N$, operating in synchronism with the remaining, processes quantities x_{jk}, y_{jk}, u_{jk}, v_{jk} and w_{jk}, where $k = 1, 2, \ldots$, in the order indicated. Particle parameters x, y, u, v and w are represented by 32-bit words; therefore, $N = 8$.

The following difference equations form the internal cycle of the computing model:

$$(\mathbf{V}_i^{n+1} - \mathbf{V}_i^n)/\Delta t = \frac{q_i}{m_i}\mathbf{F}_i^{n+\frac{1}{2}} + \frac{q_i}{m_i}\mathbf{V}_i^{n+\frac{1}{2}} \times \mathbf{H},$$

$$\left(\mathbf{r}_i^{n+\frac{3}{2}} - \mathbf{r}_i^{n+\frac{1}{2}}\right) \Big/ \Delta t = \mathbf{V}_i^{n+1},$$

$$\rho(\mathbf{r}) = \sum_g \sum_i q_i [S(\mathbf{r} - \mathbf{r}_g) + \Delta \mathbf{r}_i \nabla_{\mathbf{r}_g} S(\mathbf{r} - \mathbf{r}_g)],$$

$$\Delta \mathbf{r}_i = \int_W (\mathbf{r} - \mathbf{r}_g) S(\mathbf{r} - \mathbf{r}_i)\, dW,$$

$$\mathbf{F}(\mathbf{r}_i) = \int_W \mathbf{E}(\mathbf{r}) S(\mathbf{r} - \mathbf{r}_i)\, dW,$$

where W is the calculation field; E and H represent the strength of the electric and magnetic fields; S(r) is the distribution law for the density of the particles in the space; r_i, V_i, q_i and m_i represent the coordinate, velocity, charge and mass of the i-th particle; r_g is the coordinate of the g-th point in the Eulerian net and ∇_{r_g} is the derivative in terms of r at point r_g.

The first two of these equations represent difference analogues of Newton's equations for particles, and the third represents the distribution of the charge density in space, calculated according to the following algorithm: The distribution of the charge density of each macroparticle

$$S(\mathbf{r} - \mathbf{r}_i) \sim \exp(-\beta(\mathbf{r} - \mathbf{r}_i)^2)$$

is expanded into a Taylor series around the nearest net points with an accuracy of linear terms, and the contribution of the density of all macroparticles is summed.

In order to shorten the period of operation of the internal cycle, quantities not depending on specific values of the coordinates and velocities of particles are computed at the start step or at the step of calculating the electrostatic field.

It is possible to single out several basic algorithms implementing the internal cycle: 1) determination of Eulerian net points closest to a given macroparticle; 2) determination of distances from a particle to nearest points; 3) calculation by means of an interpolation formula of the force acting on a macroparticle from the electrostatic field, from values of the field strength at the closest points of the Eulerian net; 4) determination of V_i^{n+1} ; 5) determination of $r_i^{n+3/2}$; 6) distribution of the charge density of a macroparticle at nearest points of the Eulerian net.

An analysis of specific arithmetic expressions implemented by means of the algorithms enumerated above has demonstrated that, according to equation (*) [footnote 1], with N = 8 the parallel execution of "serial" algorithms in eight processors proves to be more effective.

The sequence for running algorithms in each iteration of the internal cycle is 1, 2, 3, 4, 5, 1, 2, 6. All algorithms are linear. The nature of the distribution of data presented above makes it possible for eight processors to have access to the memory for data in parallel with computations when running algorithms 1, 2, 4 and 5. Therefore, these steps of the internal cycle are multiprocessed for eight flows of data.

Steps 3 and 6 are multiprocessed for two flows since generally particles can be positioned near random points of a Eulerian net. These net points cannot be ordered in succession in the memory, which does not make it possible to compute in eight processors in parallel with access to the memory. It proved most effective to multiprocess individual steps in terms of the number of independent memory access channels operating in parallel.

The internal cycle of the problem was programmed in autocode, which made it possible to reduce its length to 200 machine operations taking into account operators for the preparation of data readout. Taking into account the structure and specifics of the problem as a whole, it was possible to multiprocess the internal cycle essentially in terms of macroparticles. Here 60 percent of the internal cycle was multiprocessed for two flows of data and 40 percent for eight flows. The complete processing of eight macroparticles is accomplished in 200 operations of the internal cycle; thus, the time required to process a single macroparticle, taking multiprocessing into account, equals

$$\Delta t = \frac{200 \cdot 1{,}8}{8} = 45 \ \mu s$$

A discrete Fourier transform (DPF) was used in the computing model in calculating the self-consistent electric field at points of the Eulerian net.

Let us demonstrate how this transform is multiprocessed, using the example of a direct DPF of a function assigned in a two-dimensional Eulerian net measuring R X R net points.

The DPF equation in this case looks like the following:

$$F(k,l)=\sum_{n=0}^{R-1}\sum_{m=0}^{R-1}G(n,m)e^{-i(kn+ml)},$$

$$k=2\pi\lambda/R,\ \lambda=0,\ 1,\ \ldots,\ R-1,$$

$$l=2\pi\nu/R,\ \nu=0,\ 1,\ \ldots,\ R-1.$$

Let us represent this two-dimensional DPF as the superposition of two unidimensional:

$$F(k,l)=\sum_{n=0}^{R-1}\Psi(n,l)e^{-ikn}, \tag{2}$$

$$\Psi(n,l)=\sum_{m=0}^{R-1}G(n,m)e^{-ilm}. \tag{3}$$

Now each of transforms (2) and (3) can be executed in parallel in synchronous processors.

For example, for $\Psi(n, \ell)$: $\Psi(j-1+N(k-1), \ell)$ is computed in the j-th processor, where $j = 1, 2,\ldots, N$; $k = 1, 2,\ldots R/N$; and N is the number of processors (in the model R is a multiple of N).

Thus, implemented in synchronism in all processors is a linear algorithm for a rapid Fourier transform (BPF) similar to that described in [7]. This results in N-fold acceleration of the computing process.[3]

In a real system for simulation on an M-10 computer is employed a program for a BPF of a complex data array, and the imaginary parts of the transformed quantities are assumed to equal zero. In this case the field components on which the transform is performed will have a dimensionality of 64 bits, i.e., the number of processors operating in parallel equals $N = 4$. Taking into account the estimates presented above, the computing time equals $1/4\cdot 0.75\cdot 10^9$ cycles, or approximately 6 min per session.

In the computing model discussed is employed an analytical assignment of the initial coordinates of particles and a random assignment of the initial values of velocity components, but one obeying the distribution law known at the initial moment of time. This step makes possible substantial synchronous multiprocessing, but it is not discussed in view of the slightness of its contribution to the total simulation time.

Input/Output Parallelism

As already mentioned, a considerable part of the information on macroparticles is carried on magnetic disks. However, the input/output rate for widely used MD's of the YeS-5052 type proves to be substantially below the processing speed. In fact, the serial readout and writein of a single track containing 180 macroparticles requires 50 ms without taking into account positioning of the MD heads, whereas the processing of 180 macroparticles requires approximately 8.1 ms, which results in a mismatch of approximately 5 min between processing and input/output in each simulation time interval.

Taking into account the considerable excess of the rate of exchange between levels of the internal storage over the processing speed, it is certainly advisable to place the maximum possible number of macroparticles, $Q = 200,000$, in the internal storage. These macroparticles can be processed during the input/output waiting period, which results in some reduction of the mismatch to approximately 3.5 min. This mismatch all the same is very great and results in unproductive expenditures of more than 55 h with a useful computing time of: $\Delta t \cdot M \cdot 1000 = 45\ \mu s \cdot 10^6$ macroparticles $\cdot$ 1000 intervals = 12.5 h , where M is the total number of macroparticles in the system.

In order to reduce input/output waiting losses it is possible either to use MD's with a higher speed or to employ input/output parallelism, which is made possible by the computing system's multiplex channel. Taking into account the actual hardware of the computing system, we will discuss only the second method.

First let us assess the conditions for matching the system in terms of data input. We will assume that the input of data for $(M - Q)$ macroparticles into the internal storage is accomplished through P disk lines. To each line is connected a certain number of disk tracks, read serially.[4] Number P must obviously be selected so that macroparticles read through P parallel channels during time τ (the time for reading in a single track) are processed during the same time or a somewhat shorter time. Since the processing of P tracks should take no longer than τ , and the parallel readin of the same P tracks is completed in no longer than 2τ (in a total of 3τ), it is sufficient to have in the memory three cyclic input buffers. Each buffer contains P fields one track long, corresponding to specific disk lines.

A more precise condition for matching the processing and data input speeds is based on the fact that in each simulation time interval the input time (taking into account positioning of the MD heads[5]) must be approximately equal to the time for processing the total number of macroparticles, including those in the internal storage:

$$M\Delta t \cong 1{,}1\tau\ ((M - Q)/Pm).$$

Let us determine the system's net utilization factor:

$$K = \frac{M}{M-Q}\frac{Pm\Delta t}{1,1\tau}.$$

It is clear that having assigned a specific value for K we can always achieve matching of the system by varying P and, within certain limits, M. Thus, for obtaining $K = 1$ with $M = 10^6$, $P = 2.75$ is required.[6]

However, it is desirable that K be somewhat lower than one, which makes it possible to ensure the required stability of the system with an increase in the duration of the internal cycle, e.g., for purposes of debugging, handling failure situations, calculating dynamic characteristics to be read out, etc.

Taking into account the experimental nature of the project, for the simplicity of implementation let us select the following parameters for the system: $M = 920{,}000$ (two full disk packages) and $P = 2$, which makes possible $K = 0.75$. These parameters make it possible to conduct a complete simulation session in 15.3 h with a net computing time of approximately 11.5 h. Let us note that in solving a similar problem with a special-purpose computer [8], with the lack of the ability to perform input/output in parallel with computations, approximately 73 percent of the simulation time is lost in waiting for input/output. Furthermore, simulation of a system with $M = 10^6$ and with a number of steps equal to 1000 takes approximately 83 h.

In making the estimates above it was assumed that the output of processed information to be used in the next time interval is organized similarly to the input, i.e., also in parallel and with the same number of parallel lines and cyclic output buffers. Furthermore, after processing, the information read out of the internal storage is read into its former location, and information read from input MD's, into the same location in the output MD. At the next simulation time interval the output MD is used as the data source and the input MD for output, and so forth. Thus, in order to achieve the indicated efficiency of the system it is necessary to employ four parallel input/output lines.

The multiprocessing procedure presented and the proposed results of the implementation of this project make it possible to conclude that the utilization of synchronous multiprocessor computers for purposes of numerical simulation of physical processes is promising. In particular, this makes it possible to assert that the utilization of the facilities suggested will be quite effective also in other problems which can be solved by the method of macroparticles, e.g., in hydrodynamics problems [9].

Further development of the simulation system will obviously proceed along two lines. First, along the line of development of the computing model, e.g., by taking collisions into account [10], which also makes considerable multiprocessing possible, of increasing the linear dimensions and dimensionality of the simulated system, etc. Second, along the line of development of the software and hardware by connecting visual display equipment (a display and graph plotter), a raw data file and, possibly, a BPF hardware processor.

The project described has been implemented in an experimental variant (without MD's), basic test calculations have been performed and the results of simulating specific physics problems have been obtained.

Calculations have demonstrated that for a system of 80,000 particles with a net of 4096 points the simulation of 1000 time steps takes approximately 1.5 h. The difference between the real simulation time and the calculated is explained by the lengthening of the internal cycle on account of operators of a debugging nature, whereby the net computing time equals, as was proposed, approximately one hour.

The authors are grateful to A.M. Prokhorov, M.A. Kartsev and S.I. Anisimov for their valuable advice.

FOOTNOTES

1. There are problems in which the creation of a "multiprocessed" algorithm and the calculation by it of several sets of data is more effective than the parallel processing of these same sets of data according to a "serial" algorithm. For example, it is known [2] that for random arithmetic expressions the number of operations of a "multiprocessed" algorithm is $m \geq \log_2 n$, where n is the number of operations of a "serial" algorithm.

   Let it be required to process K sets of data. Then the parallel calculation of them in N processors according to a "serial" algorithm requires Kn/N operations (whereby for simplicity K is a multiple of N), and the calculation of these same steps according to a "multiprocessed" algorithm requires Km operations. The first method will be clearly faster if

$$Kn/N < [K \log_2 n] < Km \quad \text{or} \quad N > [n/\log_2 n]. \qquad (*)$$

2. This agrees well with the results of [6] in which the implementation on a BESM-6 of a simpler algorithm reduces a total of twofold the estimate given.

3. It is obvious that multiprocessing can be performed in a similar manner for a three-dimensional Eulerian net.

4. This can be accomplished physically by connecting one or more storage units to a single control unit.

5. In taking positioning into account, it is assumed that the information on the MD occupies a specific number of complete disk package cylinders. A single positioning is required to read 10 tracks, i.e., a reading period of 1.1τ for one track.

6. For achieving $P = 2.75$ it is necessary to have three parallel lines, but three tracks are read from one line in four revolutions of the disk unit.

Bibliography

1. Kartsev, M.A. "The M-10 Computer," DOKL. AN SSSR, 1979, 245, No 2.

2. Kuck, D.J. "A Survey of Parallel Machine Organization and Programming," ACM COMPUT. SURV., 1977, 19, No 1.

3. "Vychislitel'nyye metody v fizike plazmy" [Computing Methods in Plasma Physics], Moscow, Mir, 1974.

4. Dawson, J.M. "Contribution of Computer Simulation to Plasma Theory," COMPUTER PHYS. COMM., 1972, 3, suppl., 79-85.

5. Soroko, L.M. and Strizh, T.A. "Spectrum Transformations on Digital Computers," SOOBSHCH. OIYAI, Dubna, 1972.

6. Polyudov, A.N. "Realizatsiya modeley makrochastits na EVM" [Implementation of Models of Macroparticles on a Computer], Preprint, IPM AN SSSR, No 160, 1979.

7. Gentleman, M.M. and Sande, G. AFIPS PROC., 1966, 29, 563.

8. Kamimura, T., Dawson, J.M., Rosen, B., Culler, G.J., Levee, R.D. and Ball, G. "Plasma Simulation on the CHI Microprocessor System," UCLA, PPG-248, 1975.

9. Kharlou, F.Kh. "Numerical Method of Particles in Cells for Hydrodynamics Problems" in "Vychislitel'nyye metody v gidrodinamike" [Computing Methods in Hydrodynamics], Moscow, Mir, 1967, p 316.

10. Ivanov, M.F. and Shvets, V.F. "One Approach to Simulating a Plasma with Collisions by the Method of Particles," DOKL. AN SSSR, 1978, 238, No 6, p 1324.

[8144/0522-8831]

8831
CSO: 8144/0522

AUTOMATED CONTROL SYSTEMS: EXPERIENCE AND PROSPECTS

Kiev NAUKOVEDENIYE I INFORMATIKA in Russian No 20, 1979 pp 3-14

[Interview with Academician V.M. Glushkov by Yu.M. Kanygin]

[Excerpts] [Question] What were the difficulties of the beginning period of the Ninth Five-Year Plan period in making ASU's [automated control systems] widespread?

[Answer] The first difficulty was a shortage of personnel. During the five-year plan period with a very great effort (we planned it together with the USSR Ministry of Higher and Secondary Special Education) the number of qualified developers of ASU's increased only twofold. Why not more? It was possible, of course, to open many institutes and departments, but the fact is that it is first necessary to have qualified teachers. But there is nowhere to get them from; it was necessary to train them, too, which required several years. It was not possible during a single five-year plan period to increase drastically the number of ASU specialists. Here we were helped much by party agencies, primarily by the CPSU Central Committee. The wide-scale retraining of personnel was organized and the Institute of Control of the National Economy was created, where even ministers began to receive retraining. And the same is true at all other levels. All forces were rallied. Nevertheless the shortage of qualified teachers to a considerable extent slowed the process of training personnel in the field of ASU's.

The second difficulty is that a timely decision was not carried out regarding the changeover to third-generation computer hardware and the entry of new equipment into service was late. For example, YeS [unified system] machines appeared among us only toward the end of the Ninth Five-Year Plan period, whereas according to the original plans they should have appeared earlier.

The third difficulty is an organizational one. The fact is that (and I in my speeches and various written material have brought attention to this fact) we can effectively carry out an expanded program for the introduction of ASU's only by changing over to a new technical policy, namely, a policy of standard design solutions and industrial methods, e.g., as is done in construction, where standard building projects are developed which are then quickly keyed to a specific locale (conditions) and are carried out by industrial methods of construction. In the group of industries in which we were working the changeover to the standard design of ASU's was accomplished as early as 1967-68, and this produced its effect. For example, in one industry during four years of the Ninth Five-Year Plan period the labor productivity of project engineers increased more than fourfold as the result of the standardization of ASU designs. But, unfortunately, this was not done in the entire series of industries, which was not able not to produce elements of inefficiency in the creation and utilization of ASU's. It must be said right out that many managers of enterprises, institutions and departments, having been attracted to ASU's by the fad, were not completely aware of the complexity of this task. And, indeed, the creation of a really effective ASU even for not so large a machine building enterprise (say, with 10,000 workers) is no less complicated a problem than the development of an automatic system for controlling a spaceship.

In terms of the amount of equipment which must be enlisted, these problems are approximately identical in terms of complexity. But in terms of the amount of programs and software an ASU for a plant is a few hundred times more complicated than an automatic system for controlling a spaceship or rocket. And as far as data support is concerned, i.e., the amount of data to be entered into the computer, then a system for controlling a plant is dozens of thousands of times more complicated than a system for controlling a spaceship or rocket. I emphasize that we are talking about a present ASU, and not about some kind of fiction.

[Question] Yes, but systems for the automatic control of rockets are made by KB's [design bureaus] where very many people work on each rocket system. Does this mean that we should have design bureaus of this sort for serving each plant?

[Answer] No. My comparison of the complexity of creating an ASU for an enterprise and systems for controlling space rockets is possibly confounding. But the whole thing is that unlike problems in controlling space rockets, each of which is unique, in economics it is possible to standardize individual problems. For example, it is possible to create accounting programs once for all branches of industry and for all enterprises regardless of whether this enterprise is a flour milling or machine building enterprise. Therefore it is precisely the ability to standardize which makes it possible to develop ASU's in the national economy. This requires a suitable organizational form and accuracy in the work of the various partners. With us our efforts are often scattered. And what is gotten as a result? Those who regarded ASU's as a fad bought machines and then saw that it is difficult to solve problems of real importance to production and went along the path of least resistance. They began to compute wages on the computer and to solve other quite simple problems. But we a long time ago, even in the 50's, warned that we could not repeat the American approach to the development of automation in economics. The Americans did not immediately make automated systems for controlling enterprises as we understand it now and as we understood it even in the 60's; they began to solve very simple problems in accounting, of materials and equipment inventory records, etc., and gained a saving mainly by letting clerks go.

But the fact is that the wage level of clerks in the USA and of our office employees is completely different. With us a qualified worker running a machine can earn more than a bookkeeper. Therefore in our situation a wage advantage is not gained if a bookkeeper is replaced by a technician operating a machine, whereas in the situation in the USA such an advantage was gained. In the USA it is possible to begin the job by solving very simple problems of this kind, but for us this approach was forbidden from the very beginning. For us the most important thing is to gain a saving in production by introducing systems in planning and control and by improving on this basis the quality of plans themselves, as well as of all organizational work. But it is precisely in this formulation that the introduction of ASU's emerges as a complicated problem. Let me clarify this with an example.

We know that the USSR Ministry of Finances is responsible not only for the organization of recordkeeping on the scale of the entire State or at the level of individual ministries, but also for the organization of accounting in all components of the economy right up to the primary. It approves the appropriate documents, procedures, etc. Therefore, accounting is somehow unified with us. True, it adapts slowly to new technical conditions and has not a few shortcomings, but nevertheless in this case some kind of system is present. But look, the USSR Gosplan considers itself responsible only for the drawing up of a plan by itself and in ministries, but how planning is conducted at an enterprise is not its business. It supervises and approves only planning indicators. But what procedures are there for making planning decisions? By what documents is recordkeeping guided? Each enterprise solves these problems independently. And as a result it turns out that independent action takes place in solving many vital problems in planning and control.

[Question] Have these problems really not been assigned to Gosplan?

[Answer] No, they have not. Therefore, first the Novocherkassk and then the Saratov system of planning, control, etc., has arisen. I am not opposed to one or the other. On the contrary, the initiative and creativity of the provinces are important. But it is important to look at the other side of the coin, too. Today the area of making and implementing planning decisions and organizational procedures can hardly be considered a subject for initiative and independent action. Unification is needed here. If procedures are not unified and one plans one way and another a somewhat different way according to different documents, then you will not pile up, as they say, programmers and other developers of ASU's.

On the whole the problem of the agencies responsible for the standardization and unification of planning decisions and procedures is a big question. It would be useful to study it more deeply and to elucidate it in greater detail in the press.

[Question] Is it necessary in your opinion to create an all-Union department which would step forth in the role of the client for ASU's? And is this department to have the right to supervise all other departments which are users?

[Answer] Completely correct. But not only the right to supervise. The majority of expensive computing equipment should be in its cost-accounting possession. It should lease equipment. The telephone, for example, is not on our institute's account, but on that of an enterprise of the Ministry of Communications. Our institution leases the telephone, although it costs a kopeck as compared with a computer. And it pays a rental fee for it. This is how it should be with complicated computing equipment. A rental fee sum should be established for it. And if anyone is "ineffectively" paying for a machine, let him notify a specific department which will then take it away and install it for someone r whom the use of a computer produces a saving.

[85-8831]

8831
CSO: 1863

UDC 681.322.078

ON AN ANALYSIS OF THE DATA TRANSMISSION MODES IN THE SUMMA COMPUTER SYSTEM

Novosibirsk VYCHISLITEL'NYYE SISTEMY in Russian No 80, 1979 pp 81-84

SEDUKHIN, S. G.

[From REFERATIVNYY ZHURNAL: AVTOMATIKA, TELEMEKHANIKA I VYCHISLITEL'NAYA TEKHNIKA in Russian No 12, 1980 Abstract No 12B38 by T. M. Kuznetsova]

[Text] The dialog and monolog data transmission modes between elemental machines (EM) in a homogeneous computer system of the SUMMA type are analyzed; data transmission is accomplished by means of program and hardware under the control of an operating system. The indicated modes are treated from the viewpoint of interactions between the control EM's (that elemental machine, the operating system of which at the current point in time services the queries for remote interaction) and the controlled EM's (the EM subscribers). The timewise efficiency of the realization of the indicated modes is evaluated as a function of the number of EM subscribers for a query and the length of the information portion of a packet in which the operating system converts the messages intended for transmission through the communications network of the computer system. The increased efficiency of SUMMA type computer systems due to the presence of two data transmission modes when servicing remote interaction queries is noted. Figures 1; references 5.

[91-8225]

UDC 681.322.066

PARALLEL DATA PROCESSING IN THE HOMOGENEOUS SUMMA COMPUTER SYSTEM

Novosibirsk VYCHISLITEL'NYYE SISTEMY in Russian No 80, 1979 pp 85-89

KASHUN, I. N. and SEDUKHINA, L. A.

[From REFERATIVNYY ZHURNAL: AVTOMATIKA, TELEMEKHANIKA I VYCHISLITEL'NAYA TEKHNIKA in Russian No 12, 1980 Abstract No 12B131 by T. M. Kuznetsova]

[Text] A homoegenous computer system of the SUMMA type is treated, which is intended for the solution of problems represented in the form of a system of asynchronous interacting processes. The capability of simultaneous organization of matrix and conveyor data processing modes is demonstrated within the framework of the SUMMA operating system. The major features of the indicated modes are analyzed and schemes are given for their realization. The efficiency of the realization of the multiple instruction flow--multiple data flow mode is noted. Figures 2; references 3.

[91-8225]

UDC 658.5.011.56:621.31

FUNCTIONAL SUBSYSTEMS OF THE SECOND STAGE OF THE ENERGY SECTOR AUTOMATED CONTROL SYSTEM

Moscow FUNKTSIONAL'NYYE PODSISTEMY VTOROY OCHEREDI OASU-ENERGIYA in Russian 1979 (signed to press 1 Aug 79) pp 2, 174-177

[Annotation and table of contents from the book edited by engineer I.M. Alekseyeva and candidate of the engineering sciences, senior scientist I.G. Gorlov (editor-in-chief): "Functional Subsystems of the Second Stage of the Energy Sector Automated Control System", 500 copies, 188 pages]

[Text] The results of work on the design of the functional subsystems of the second stage of the electrical power engineering sector automated control system (OASU-Energiya) are contained in the papers included in this collection.

Functional subsystems being developed by the ASU [automated control system] department of the Power Engineering Institute imeni G.M. Krzhizhanovskiy (ENIN) are treated: the future development of the sector; technical and economic planning; planning, accounting for and analyzing labor and personnel; control of financial activity; control of scientific and technical progress (the Scientific Research Work Management Section); bookkeeping; control of transportation and shipping; control of material and technical supply and the specification of equipment sets (The Fuel Supply Management Section).

The collection can conditionally be broken down into two sections. The state of the art and the prospects for ASU development at various management levels in power engineering are treated in the first section of the collection and the characteristics of the functional subsystems and sets of tasks of the first and second stages are also given. The second section of the collection is devoted to questions of the construction of economic mathematical models, based on which the planning and forecasting tasks are solved, as well as various aspects of the design of the software and data support.

Table of Contents

[121-8225]

8225
CSO: 1863

UDC 658.5.011.56:621.31

THE STATE OF THE ART AND PROSPECTS FOR AUTOMATED CONTROL SYSTEM DEVELOPMENT IN POWER ENGINEERING

Moscow FUNKTSIONAL'NYYE PODSISTEMY VTOROY OCHEREDI OASU-ENERGIYA in Russian 1979 (signed to press 1 Aug 79) pp 3-6

[Paper in the book edited by engineer I.M. Alekseyeva and candidate of the engineering sciences and senior scientist I.G. Gorlov (editor-in-chief): "The Functional Subsystems of the Second Stage of the Energy Sector Automated Control System"; paper by Ye.I. Blank, V.G. Ornov, V.A. Semenov and G.A. Chernya]

[Text] Considerable work was done during the 1970's to introduce computer equipment and design ASU's [automated control systems] in power engineering. As of 1 January, 1978, the number of computer centers (VTs) in the organizations and enterprises of the USSR Ministry of ENergy reached 148. Some 306 computers were installed in the computer centers, including 180 third generation machines.

The first stages have been placed in service:

--The sector-wide automated control system (OASU-Energiya) [energy sector automated control system];

--The automated dispatcher control system (ASDU) in all integrated power systems (OES);

--Automated control systems (ASU's) in 28 power systems;

--ASU's for three electrical power network enterprises;

--ASU's for six electrical power stations;

--ASUTP's [automated control systems for technological processes] for more than 60 high power generating units.

The second stage of the Northwest Integrated Power System ASDU was placed in service in 1977. During the current five-year plan, the second stages of ASDU's will placed in service in eight more OES's and in the TsDU YeES SSSR [Central Dispatcher Control System for the Unified Power System of the USSR].

The second stages of the integrated power system ASDU's are characterized by the following features:

--The solution of the tasks of planning the operating modes and operational control based on a complex of four third generation computers (two small superimposed computers and two all-purpose intermediate performance computers);

--The refinement of the set of programs for mode planning based on the use of dialog systems and common data files;

--The organization of intermachine data exchange (between the small and general purpose computers);

--The use of small computers for the retrieval and processing of remote control data, monitoring operating parameters and warning signalling of the controller of their excursion beyond the set limits;

--The introduction of digital automatic frequency and active power control systems (TsARChM).

The second stages of the ASDU's are likewise being placed in service as a part of the complement of the organizational and production process ASU's of the power systems.

Work on the design of the integrated ASDU's of the integrated power systems and unified power system of the USSR will be expanded during the 11th Five-Year Plan. The integrated ASDU of the YeES of the USSR will represent a control system based on a network of interconnected regional control computer centers (ZuVTs) of the TsDU of the YeES of the USSR and an ODU [integrated dispatcher control] which along with planning the operating modes, provides for the solution of problems of operationally timely and automated control. The integrated ASUD of the OES [integrated power system] will take the form of a control system based on a network of interconnected control computer centers (UVTs) for the ODU's and the power systems.

The major trends in the work to refine the control of high capacity power associations based on the development of ASDU's in the next five-year plan will be:

--The organization of interlevel automated and automatic data exchange between small computers by means of a low speed data transmission network (50-200 bauds) via unswitched communications channels;

--The organization of interlevel automated data exchange between general purpose computers by means of an intermediate speed (600-1,200 bauds) data transmission network, as a rule, via switched communications channels;

--The implementation of a system for remote data processing using subscriber stations;

--The expansion and refinement of sets of algorithms for planning and operational control, maximum automation of the generation of raw data, the improvement of service as regards the representation of the output data (the introduction of display systems and graph plotters) as well as the generalization and analysis of the results of calculations;

--A gradual transition from disc operating systems to the operating system of the unified series of computers, in step with the equipping of computers with the requisite mainframe and peripheral memory volumes;

--Consolidating ASDU assignments using a single data base;

--The expansion of the application of computer assignments in the operational control cycle and the mastery of the dispatcher "adviser" mode;

--The expansion of the functions of automatic control in ARChM [automated active power and frequency control] systems as well as automation to counter emergencies.

The considerable expansion in the use of digital computer equipment facilities in automated control will be tied to the mastery of microprocessors, the production of which will increase significantly in the 11th Five-Year Plan. Work will be continued on the refinement of dispatcher centers for power systems based on the use of small and micro-computers. Along with the increase in the number of information computer centers, it is essential to expand the functions of each of them. The information accumulated in the memory of operational computers should be processed in different sections, providing for the presentation of the generalized data on power system operating modes to the technological servies personnel.

Work has continued in the 10the Five-Year Plan on the introduction of the first and second ASU stages for power systems. The first ASU stages, designed around second and third generation computers, provide for the solution of major planning and organizational-economic control tasks using computers. During 1978-1980, the first ASU stages will be brought on-line in an additional 25 power systems and in 16 electrical power network enterprises.

The second ASU stages are being created in 14 power systems, which along with the ASDU tasks noted above, are also characterized by the following directions of the work in the field of organizational-economic control:

--The expansion of the set of tasks (including optimization tasks) which can be solved using a third generation computer;

--The organization of a system for gathering and transmitting technical economic data, designing primary data processing and transmit stations as well as reference stations (affiliates of the control computer center of a power system);

--The utilization of power system control computer center to solve the problems of individual enterprises (electrical power stations, electrical power network enterprises, etc.).

In the 11th Five-Year Plan, along with the continuation of work on the introduction of the first and second ASU stages, the design of integrated organizational and technological ASU's (ASU OT) of power systems is being started. The integrated ASU OT's of power systems will take the form of sets of ASU's of enterprises and production units incorporated in a power system and functionally and informationally tied to the hardware and personnel of the regional power engineering administration in a single process for the control of the generation, transmission and distribution of electrical power and heat.

As regards the technological control, the power system ASU OT's will provide for mode planning, as well as the operationally timely and automated control within the complement of integrated ASDU's of the integrated power systems and unified power system of the USSR.

As regards organizational and economic control, a provision will be made for the solution of sets of problems (targeted control) with an optimum amount of automation for all control levels.

The design of ASU's for electrical power network enterprises (PES's) was started in the 10th Five-Year Plan. This work will be continued in the 11th Five-Year Plan. Automated control systems will be designed for TES's, repair enterprises, the power marketing administration, etc.

Considerable work was done during the 9th and 10th Five-Year Plans to develop the principles and design automated control systems for heat and electric power stations and nuclear electric power stations. These ASU's solve primarily information and computer control problems. The possibilities for modern computer complexes make it possible to begin the transition in the 11th Five-Year Plan to a new stage in the control of heat and electric power stations as well as nuclear electric power stations: the mastery of automated control functions.

In GES automated control systems, where automatic functions have become considerably more widespread, their further development is ahead as regards the automatic control of normal and emergency modes. In this case, as has already been noted above, microprocessors will be widely used in the hardware complement of ASU's for the electrical power stations. The widescale introduction of computer equipment in the ASUTP's for electrical power network substations should be started using microprocessors as the basis.

[121-8225]

8225
CSO: 1863

UDC 658.5.011.56:621.31

EXPERIENCE WITH THE USE OF THE FIRST STAGE DATA BANK AND SET OF PROGRAMS FOR THE ANALYSIS OF DEVELOPMENTAL VARIANTS FOR INTEGRATED POWER SYSTEMS IN THE SUBSYSTEM FOR FUTURE SECTOR DEVELOPMENT

Moscow FUNKTSIONAL'NYYE PODSISTEMY VTOROY OCHEREDI OASU-ENERGIYA in Russian 1979 (signed to press 1 Aug 79) pp 51-54

[Excerpt from the book edited by engineer I.M. Alekseyeva and candidate of the engineering sciences and senior scientist I.G. Gorlov (editor-in-chief): "The Functional Subsystems of the Second Stage of the Energy Sector Automated Control System", paper by V.Yershevich, A.N. Zeyliger, E.M. Kaplinskiy, A.I. Lazebnik and L.D. Khabachev]

[Excerpt] The further development and increasing complexity of the unified power system (YeES SSSR) place increased requirements on the precision and operational timeliness of the calculations of future operating modes of regional and integrated power systems (OES's) and the unified power system as a whole. The volume of data needed for the calculations will rise with the future expansion of the YeES of the USSR and the OES as well as the number of variants considered for the long term.

Because of this, the State Scientific Research Power Engineering Institute imeni G.M. Krzhizhanovskiy, the Northwestern Branch of the Energoset'proyekt and the central dispatcher control of the Unified Power System of the USSR have developed and introduced the program and information complex: "Analysis and correction of future developmental variants for OES's" [1].

The basis for the complex is a data bank on the electrical power stations and programs for the automated determination of the major indicators for the development fo regional and integrated power systems. The set of programs and the data bank were realized using BESM-4 and M-222 computers. The data bank incorporates and information base and programs for generating, correcting and displaying the data (printout of the input documents). The follwoing are included in the information base in particular: Various dictionaries and classifiers, lists of regional power systems (RES's), which belong to a particular territorial administrative level (OES, Main Administration, Union Republic); the values of fixed power and energy overcurrents between power systems; load maxima, electrical power demand, and power reserves located within an RES; information on the installed and available capacities of the generator sets of existing electrical power stations, as well as those being expanded and newly brought on line. The data bank is designed for the inclusion of information of all 93 regional power systems, with the consideration of the prospects for 10 to 20 years ahead.

The program incorporated in the complex make it possible to obtain the following summary and reference indicators for OES development at various territorial and time levels: the plan for bringing capacities on line at electrical power stations; the capacities at electrical power stations, taking into account that brought on line in the fourth quarter; the plan for the elimination of gaps in the capacities at electrical power stations; the plan overloads for electrical power stations; the removal of capacities at electrical power stations; a listing of electrical power stations and their generation sets, indicating the installed and available capacities; summary indicators for the operating conditions and growth of electrical power consumption; and an expanded power capacity balance sheet.

The first stage of the complex was placed in service in 1975 in the TsDU of the USSR YeES. The desires of users to change the forms of the input documents were taken into account in 1976 and 1977, and the programs of the complex were modified. At the present time, the program information complex is in operation in the future development services of the TsDU of the USSR YeES, the ODU Yuga [integrated dispatcher control system of the South] (1975) as well as central Asia, Siberia and in the power system planning departments of the Energoset'proyekt Institute, its Cental Asian (1976), Northwest, Siberian, Gor'kiy (1977) and Ukrainian (1978) departments.

The operational experience has shown that the major input information satisfies the TsDU and ODU services in terms of its form, as well as the planning sub-division of the Energoset'proyekt Institute. At the same time, the raw data differs substantially in terms of its degree of detail and consolidation, as well as in terms of the length of the period being considered (for TsDU's, it is five to seven years and for the Energoset'proyekt Institute, 10 to 20 years).

The tasks of analyzing the development of power systems, which can be solved in the TsDU's, ODU's and the planning subdivisions are differentiated with respect to the composition of the tasks and to the factors and representational forms which are taken into account for the calculated results. In this regard, various versions of program complexes have been developed which take into account specific features of the solution of these problems in different organizations.

Work was completed in 1977 on the tying-in of a set of programs to the data bank on electrical power stations for the compilation of the annual energy balance sheets [2]. These programs are designed for the determination of the electrical power output at individual types of electrical power stations, and the dsitribution of the generated power according to the types of fuel, as well as the determination of the shortfall or excess of energy in regional power systems. The calculation routines for the energy balance sheets are being used in the future development services of the central dispatcher control for the USSR unified power system and the integrated dispatcher control for the South (1977).

The data bank software for electrical power stations which has been developed [1] was used to design a data bank for electrical power network facilities at vltages of 220 KV and above. The data base of this bank contains information on the major parameters of the electrical equipment (transformers, switches, compensating devices, power transmission lines). Programs are tied into the information base which provides for the retrieval of summary and reference indicators (both reporting and planned) on the status and operational modes of the electrical power network of integrated power systems.

Information has been prepared on the power mains facilities of the Tsentr and Northern Caucasus integrated power systems and experimental calculations have been made for the TsDU of the USSR YeES and the Energoset'proyekt Institute.

The program for optimizing the operating conditions of electrical power stations when covering future daily load schedules of integrated power systems, the "Rezhim-M", has found widespread applications in project planning calculations [3, 4]. This program has also been realized on the BESM-4 and M-222 computers. The "Rezhim-M" model uses data from the bank on electrical power stations, but is not interfaced via a program to the bank. The program is used in the long term calculations in the future developmental services of the TsDU of the USSR YeES, the Northwest ODU [5], the South ODU and in the power system planning departments of the Energoset'proyekt Institute and its divisions: the Northwest, Central Asian, Gor'kiy, Ukrainian, Siberian, Urals, Kazakh, Far East and Southern. In 1976, the program was rewritten in the PL/1 language for third generation computers by the Power Engineering Institute imenin G.M. Krzhizhanov Krzhizhanovskiy in conjunction with the Northwest ODU.

At the present time, a new program has been developed in the Power Engineering Institute imeni G.M. Krzhizhanovskiy for the optimization of future operating conditions of electrical power stations, in which the desires of users to increase the parameters and volumes of the raw data were taken into account, as well as desires to determine the operating modes of hydroelectric power stations taking into account limitations on overcurrents via internodal links, for additional service of the program, etc. The program has been introduced into the TsDU of the USSR YeES.

BESM-4 and M-222 computers will be operated for a few years yet in the Energoset'proyekt Institute and its divisions. Because of this, the decision was made that all of the departments of the institute should make use of the data bank on electrical power stations, the set of programs for analyzing the developmental vairants of integrated power systems, and the program for optimization of the operating conditions of electrical power stations when developing schemes for the expansion of integrated power systems. In this case, the forms of the input documents obtained from the computers should be incorporated directly in the project planning documentation.

Operational experience with the data bank has demonstrated that one of the most important questions if the preparation of the data base. The gathering, checking and correction of the information comprise an extremely significant volume of work. The future developmental service for the TsDU of the USSR YeES prepared information for a seven year period (1974-1980) on 93 regional power systems and on more than 1,000 electrical power stations. This information was used in 1975-1978 to operate the set of programs for the analysis of the development of power systems on the M-22 computer and was continuously corrected during this period. This same information served as the basis for the preparation of the data base for the third generation computer.

The reprocessing of considerable volumes of data on computers for the solution of a large number of problems in the ongoing analysis of power system variants when planning and preparing proposals for the plan for the construction and bringing power facilities on line makes it possible to considerably improve the substantiation of the decisions based on more reliable information and a review of a large number of variants.

The experience acquired in the operation of the first stage of the data bank has made it possible to formulate the requirements placed on the second stage, taking into account the desires of various users, the expansion of the complement of tasks involving the analysis of power system development variants and the refinement of procedures and algorithms for solving the problems [7].

[121-8225]

8225
CSO: 1863

DISPATCHING GEOPHYSICAL COMPUTING COMPLEXES BASED ON THE PS-2000 MULTIPROCESSOR COMPUTER

Moscow PRIBORY I SISTEMY UPRAVLENIYA in Russian No 2, Feb 81 pp 29-31

[Article by Academician V. A. Trapeznikov, director, Institute of Control Problems, Academician of the Georgian Academy of Sciences I. V. Prangishvili, deputy director for scientific work of the Institute of Control Problems, Candidate of Technical Sciences A. A. Novokhatniy, director of the Scientific Research Institute for Control Computers, Candidate of Technical Sciences V. V. Rezanov, deputy director for scientific work of the Scientific Research Institute for Control Computers]

[Text] Seismic prospecting is the main method of exploratory geophysics, which is the basis of contemporary search and exploration for oil, gas and other valuable mineral deposits.

The set of instruments and equipment used in contemporary seismic prospecting includes: impulse and vibration sources for stimulating longitudinal and transverse waves; seismic recording stations (systems) with varying number of channels (from 24 to 500 or more channels); dispatching and regional computing complexes (EGVK and RGVK) for immediate processing of seismic prospecting data at dispatching and regional geophysical computer center (EGVTs and RGVTs). The EGVK carry out the immediate and in-depth processing of seismograms which are recorded in the field on magnetic tape by seismic recording stations.

The required performance of each EGVTs and, consequently, of each EGVK for processing seismograms can be determined in the following way: the amount of initial data which must be processed immediately during a single year is determined by the work of the 10-15 seismic field brigades within an expedition and reaches 120,000 physical observations per year. Taking into account the peak load during the field-work season, an EGVTs must permit the processing of about 150,000 physical observations, which corresponds to the processing of initial data in the amount of 2.5×10^{10} words. The depth of the immediate processing to the level for obtaining a time profile of the geological structure reaches up to 10^4 operations per word of initial data. Therefore, it is necessary to execute 2.5×10^{14} operations per year. Since up to 50% of the initial data is subject to in-depth processing, which requires 4×10^4 operations per initial word, the EGVTs receives 5×10^{14} operations per year. This corresponds to an EGVTs (EGVK) having an average performance of 2.5×10^7 operations per second and operating 6000 hours per year.

Currently existing EGVKs, based on second and third generation Soviet computers, do not satisfy contemporary requirements for speed (time) of processing seismic prospecting data due to insufficient computer performance. Therefore, at the present time, the EGVTs carries out the processing of only a portion of the collected seismograms and even this processing is not sufficiently in-depth.

In order to increase the geological effectiveness of seismic prospecting work and to speed up the preparation of data on reserves of oil, gas and other valuable minerals, it is necessary to create and equip EGVTs with modern, high-performance computer systems. Their performance will be 10 to 100 times greater than that of present systems and they will make possible in-depth immediate processing of all necessary seismic prospecting information.

The EGVK, developed at the Institute of Control Problems (Moscow) and the Scientific Research Institute for Control Computers (Severdonetsk) and based on the multiprocessor PS-2000 Computer (the PS-2000 EGVK), is a high performance computing complex. It performs: the rapid and sufficiently deep processing of seismograms, the creation, using the processing results, of time and depth geological structure profiles and their output onto a specialized multichannel recorder (plotter).

The PS-2000 EGVK performs:

the input into the computer of seismic prospecting data from the magnetic tape of the field digital measuring recording stations (about 50 tests--physical observations are recorded on each magnetic tape; during each 6 second test, the amplitude of the seismic waves, which come from 48 sensors-seismographs, is measured each 2 microseconds);

the preliminary processing of field seismic records;

the immediate processing of data received during profile and area seismic studies using the multiple superimposing method;

the receipt of time and depth geological structure profiles of the earth's crust;

the autonomous pre-processor processing of seismic prospecting data for subsequent transfer to the RGVTs for further, more in-depth and comprehensive processing;

and the output of data onto an electrostatic plotter, photo plotter and color display.

To solve the above-mentioned problems at the EGVTs, the following algorithms for processing physical observations are used: demultiplexing and editing of information, its summing vertically, correction of wave front and absorption differences, normalization, correlation of seismic vibration data, its multipurpose filtering, sorting of tracks, input of static and cinematic corrections, summing, final filtering and editing for output of results.

Operations performed during the processing of geophysical data, such as summing, averaging, scaling, recoding, fast Fourier transforms and so on, are well suited for parallel and iterative execution. Thus, the problem of processing seismic prospecting information is a typical group data processing problems.

Within the PS-2000 EGVK, the multiprocessor PS-2000 computer is responsible for solving regular highly parallel vector and matrix problems which permit group processing. An SM-2 computer, which fulfills the function of a dispatcher, solves all possible irregular problems, controls the peripheral devices, and organizes the computing process.

In the PS-2000 EGVK initial geophysical data and data archives are stored on standard magnetic tapes. Temporary information storage employs 29M-byte disk packs and 800K-word fast, fixed-head disks. Input of data from the magnetic disks and tapes into the memory of the PS-200 computer processors and output from it is done either through an external memory subcomplex (SVP) with a micro-programmed controller or through an SM-2 computer.

The structure of the PS-2000 computer consists of 8, 16, 32 or 64 processor elements (PE). They are connected to each other in an identical fashion, are located under a unified control, and are of a single type. Each processing element has its own (local) direct access semiconductor 12K or 48K-byte memory. This makes it easy to upgrade the system and thus change its performance within wide limits (1,2). The performance of the minimum PS-2000 8-processor computer configuration is approximately 25 million short operations per second; the computer can process on the order of 30,000 to 40,000 physical observations per year. The maximum PS-2000 64-processor computer configuration permits a performance about 200 million short operations per second. This configuration is capable of processing up to 150,000 to 200,000 seismograms per year.

The typical PS-2000 EGVK, which contains 32 processor elements, must provide a performance sufficient for processing up to 120,000 seismograms per year (the results of the work of the 10-15 field brigades within an expedition). The PS-2000 computer, part of the PS-2000 EGVK, has a high absolute indicator for performance (25-200 million operations per second) and a high relative indicator (performance/price) for problems naturally parallel on the object or algorithm level (1, 3).

For problems distinguished by a naturally parallel character on the object level, a series of single type data is processed by a single program. Each processor processes its own object, for example, a fast Fourier transform calculation on various selections or channels. For problems which are parallel on the algorithm level, solution occurs simultaneously on all PS-2000 multiprocessor computer parallel processors. Examples of such problems are one and two dimensional fast Fourier transforms on a single selection, digital filtering, addition, multiplication and other vector and matrix operations, determination of average dispersions and high order moments, calculation of correlative and autocorrelative functions, block method solution of systems of differential equations containing partial derrivatives or ordinary differential equations, etc.

In the PS-2000 computer information exchange between separate PE and also between PE and the control unit (CU) is carried out by regular and main [magistral'nyy] transfer channels (1, 3). The regular channel connects each PE with its two closest neighboring PEs and also connects the first and last PE, thus forming a ring. It is possible to dynamically form, in a program, a regular channel of two or more identical rings each consisting of 8, 18, or 32 PEs. The regular channel is rapid. During n clock cycles it can shift operands, which are located on identical registers or in memory positions with identical addresses, n PEs to the left or right cyclically. The main information transfer channel is parallel. It allows the transmission of operands from the CU to all addressed (active) PE, from a selected PE to the CU, from a selected PE to other active PEs. Like the regular channel, the main transfer channel can, in a program, be dynamically partitioned into a series of identical subchannels.

The PS-2000 operates on 12, 16 and 24-bit words and can work in both fixed and floating-point modes. A 48-bit fixed-point processing format is also envisioned. The PS-2000 computer is a freely programmable parallel machine, which is programmed on both the micro and the macro level. The micro level is realized through 64-bit microinstructions, which are stored in the control unit's 16K 64-bit word, direct access semiconductor memory. The great majority of microinstructions are executed during one machine cycle--320 nanoseconds. The macro level is realized thanks to 24-bit program instructions, which are located in the control unit's 4K or 16K 24-bit word semiconductor direct access memory. Corresponding to each program instruction is a micro level microinstruction. The instruction set can be expanded and is oriented to the execution of large-scale operations, such as fast Fourier transforms, multiplication (rotation, addition, etc.) of matrices, vector operations and so on.

Information I/O into the PS-2000 computer memory is carried out through either a program or a hardware channel. Data transfer on the program channel occurs using a control interface (part of the control unit) in accordance with specialized programs stored in microinstruction memory. The speed of microprogram information transfer is determined by the number of microinstructions necessary to send one word and by the throughput of the SM-2 computer channels (program or direct access to the memory). The average speed is 0.3-0.4 million words per second. The hardware channel is faster (up to one million words per second) and it provides information transfer between the direct access memory of the tasked PEs and external memory devices (disks and tapes) or with the SM-2 memory. Only those PEs active in a given operation take part in the I/O for that operation. The I/O activization is mutually independent and is completely independent of the activization of PEs by processing microinstructions.

Two variants for connecting the hardware channel are possible. The first is direct data I/O to external memory (disks and tapes) through the external memory subsystem (SVP) using the standard IUS interface. The real data transfer speed is limited by the SVP throughput and reaches one million words per second. The second variant is data I/O through the SM-2 machine-dispatcher. Here information transfer is carried out with the SM-2 main memory and all peripheral devices are connected to the SM-2 by the 2K interface. Data transfer through the SM-2 has a real sending speed which is limited by the SM-2 channel and which reaches 0.7 million words per second.

Principal Specifications of the PS-2000 Computer

main memory per PE (bytes)	12K or 48K
total main memory (bytes)	
for 8 PE	96K or 384K
for 64 PE	768K or 3072K
main memory word length, excluding check bits (bits)	24
read (write) cycle (ns)	640 or 960
word length of processed numbers (bits)	
fixed point	12, 16, 24
floating point	20 (mantisa), 4 (characteristic)
microprogrammed main memory size (bytes)	128K
microinstruction word length (bits)	64
read (write) cycle (ns)	640 or 960
execution time for main operations for each PE (microseconds):	
register-register add	0.32-fixed point 0.96-floating point
register-memory add	0.96-fixed point 1.6-floating point
multiplication	1.6 and 2.24-fixed point (corresponds to cofactors of 16 and 24 bits; division of 32 and 48 bits) 1.92-floating point
fast Fourier transform execution time for 1024 binary complex numbers (ms):	
64 PEs	1
32 PEs	2
16 PEs	4
8 PEs	8
time to square a 100 x 100 matrix (transposition and multiplication -10,000 elements) for 11-8 PEs (ms)	1380
I/O information speed via hardware channel (M words/s)	1.8

The main features which distinguish the PS-2000 computer from known multiprocessor systems and which provide a high performance for a relatively low cost are the following:

the possibility of flexible dynamic segmentation and rearrangement of the complex structure depending up the structure of the data in the problem being solved;

the presence of regular and parallel (main) channels for inter-processor communications which significantly speed and facilitate inter-processor transfer operations;

extensive paralleling of the computational process using a large number of processor elements;

a hierarchical addressing structure for all memory and independent addressing and modification of the main memory of each PE which occurs at the same time a data transfers and the execution of arithmetic operations;

presence of an activization system and a chain linking PEs; exclusion from subprogram operating time of the reaction time to a central processor signal interrupt indicating the end of the previous subprogram;

combining in time data and instruction processing, which is achieved by a divided control process for selecting instructions and data from a divided instruction and data memory;

the presence in the general control unit of an independent processor for controlling indexing, activization, memory branching loops, and branches which frees each PE from these control operations and which allows the combined selection of microinstructions and a halving of the microinstruction execution time;

Structurally, the PS-2000 computer can consist of three modules: the basic (B), upgrade No 1 (U1), and upgrade No 2 (U2).

The basic module forms the minimal PS-2000 configuration and contains eight processor elements with local memory, general control device, two power packs, and an I/O channel. It fits in one rack (cabinet) having dimensions of 1800 x 1000 x 450 mm (see photograph). The processing unit, the PS-2000 control unit within the PS-2000 EGVK and the power pack are designed in the form of a partially plug-in housing which can be placed directly into the cabinet.

The U1 and U2 configurations contain, correspondingly, one processing unit, with eight PEs and one power pack, and two processing units with 16 PEs and two power packs. Both U1 and U2 fit in a single standard cabinet.

The PS-2000 EGVK software is an expanded variant of the ASPO disk basic operating system obtained by expanding the functions of the program modules of these systems and the creation of additional program modules (1).

The basic programming language for the PS-2000 is assembly, which reflects the PS-2000 microinstruction set. PS-2000 Assembly contains pseudoinstructions and assembly instructions proper. The first are designed to transmit certain information to the translator; the latter reflect the PS-2000 microinstructions. Translation from assembly into the PS-2000 microinstruction codes is done by the SM-2. For programming on the microinstruction level there is also a macro language and a high-level machine-oriented language called TRANKVIL. To develop microprograms for matrix and vector calculations on the PS-2000, the VEKTOR high-level ALGOL-like algorithmic language and a translator from the VEKTOR language into the PS-2000 microprogram language (machine codes) have been developed.

To describe the organization of the interaction between the PS-2000 and the SM-2 there has been developed: the PDL procedure description language; and a system for programming task solution processes on the PS-2000 EGVK, which has received the name of Dispatcher.

In assemble with the aid of the macro language a library of standard subprograms (procedures) has been written. It includes: fast Fourier transforms on 1024 and 4096 points in complex form in floating-point and fixed-point; matrix multiplication; multiplication of complex numbers of two vectors with 4 x 4096 points and summing with an external array; summing vectors having 1024-4096 words and located on an external device; bundling and correlation of complex numbers with 4 x 4096 points; finding maximums and minimums; etc.

The micro dispatcher controls the PS-2000 task solution process on the micro level.

Monitoring and diagnostic programs provide: checking of the complex and all its component devices in autonomous and complex modes; localization of the place of breakdowns; and reconfiguration of the complex when separate processors fail.

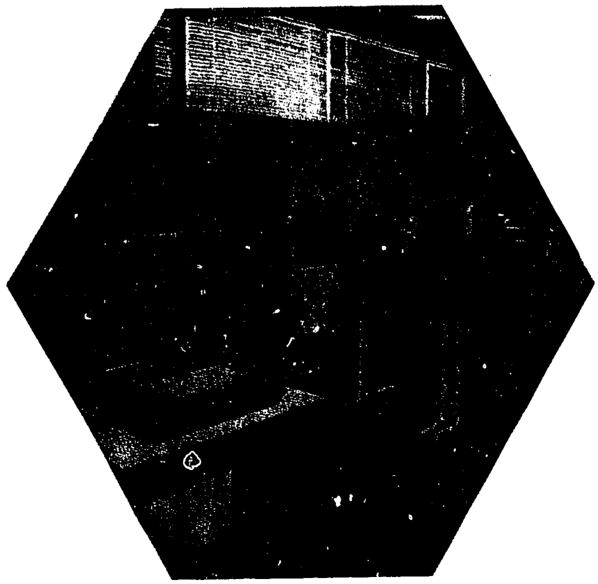
The first applied program package set for the PS-2000 has been developed. It is for route processing of seismic prospecting information and contains 7 procedures and 47 subprograms, including fast Fourier transforms, bundling calculation of correlative functions. On the basis of this first applied program package series a control problem has been composed for imitating the main stages of seismic prospecting data processing. It allows one to obtain time profiles of geological structures and is also designed for acceptance testing of experimental and serially-produced PS-2000 EGVK units.

A geophysical job language has also been created for the PS-2000 EGVK. It frees, to the maximum extent, the geophysicist from auxiliary technical work and it provides the opportunity to interact with the processing system by using geophysical terminology. This increase interaction and processing effectiveness. The geophysical job language serves as the most efficient method for composing processing jobs. It helps to optimize the operating characteristics and the resources of the processing system.

Series production of the PS-2000 EGVK in four basic configurations is envisioned for 1981. A photograph of the PS-2000 EGVK is given on the front cover of this journal [see below]. The PS-2000 was developed and produced by groups at the Institute of Control Problems and at the Impul's imeni the 25th CPSU Congress scientific production association in Severodonetsk for the 26th CPSU Congress.

The computing system (complex) which has been examined for processing seismic data using the PS-2000 computer is superior to analogous Soviet machines in the principal technical and economic indicators.

In addition to the task of processing seismic prospecting information, received during the search for various valuable minerals, the PS-2000 EGVK can be effectively used to solve many other tasks related to the processing of large streams of information, using algorithms which effectively make parallel the data processing arrays.



PS-2000 Computer

BIBLIOGRAPHY

1. Prangishvili, I. V. and Rezanov, V. V., "Mnogoprotsessornyye upravlyayushchiye vychislitel'nyye kompleksy s perestraivayemoy strukturoy: preprint No. 10," Moscow, Institute of Precision Mechanics and Computer Technology of the USSR Academy of Sciences, 1977.

2. Prangishvili, I. V. et al., "Perestraivayemaya upravlyayushchaya vychislitel'naya sistema na osnove odnorodnykh struktur: Referaty dokladov VI Vsesoyuznoy soveshchaniya po probleme upravleniya," Moscow, Izdatel'stvo "Nauk", 1974.

3. Medvedev, I. L., Prangishvili, I. V. and Chudin, A. A., "Mnogoprotsessornyye vychislitel'nyye sistemy s perestraivayemoy strukturoy," Moscow, Institute of Control Problems, 1975.

[20-P]

CSO: 1863

CONFERENCES

UDC 62-523.2:061.3

16TH ALL-UNION CONFERENCE ON MAGNETIC ELEMENTS OF AUTOMATION AND COMPUTER TECHNOLOGY

Moscow AVTOMATIKA I TELEMEKHANIKA in Russian No 11, 1980 pp 185-190

[Article by M. A. Rozenblat and G. V. Subbotina]

[Text] The 16th All-Union Conference on Magnetic Elements of Automation and Computer Technology, convoked by the National Committee of the Soviet Union for Automatic Control and the Order of Lenin Institute of Control Problems, was held in Moscow on 19-21 November 1979. Participating in the work of the conference were over 500 representatives of scientific institutions, enterprises and institutions of higher education of the country. A total of 148 reports was presented and discussed. Opening the conference, I. V. Prangishvili noted the important place occupied by magnetic elements and devices among contemporary automation and computer hardware.

In his plenary report, M. A. Rozenblat characterized the contemporary status and prospects of further development and application of magnetic technology. Among the most promising directions of the development of magnetic technology are: 1) the creation of integrated magnetic structures on the basis of functional (use of one and the same cores and windings for the simulteneous performance of different functions), physical (simultaneous use of different physical properties of a ferromagnetic) and technological integrations; 2) the creation of hybrid magnetic-semiconductor devices optimally combining the properties of the two types of elements; 3) the creation of new magnetic materials with enhanced static and dynamic magnetic, thermomagnetic, magnetostrictive, magneto-optical, etc, properties, including amorphous magnetic materials; 4) the creation of large-capacity integrated stores on the basis of mobile magnetic domains, etc.

The report of Ye. I. Kondorskiy was devoted to the contemporary concept of the magnetism of materials used in electronics. He examined the reasons for the existence of ferromagnetism in metals, oxides and powders and the possibility of using a number of physical phenomena to further improve magnetic technology.

A survey of the elementary base of the computer internal store was presented by A. A. Krupskiy, who devoted special attention to determination of the areas of advisable use of magnetic elements of various kinds.

The work of the conference proceeded in five sections.

In the section, "Domain and magneto-optical stores," B. N. Naumov, V. K. Rayev and G. I. Markarov, examining in a survey report problems in the application of domain stores in micro-computers, pointed out as the main directions of its application the external store, the store expander and a controlling store combined with a data store.

The reports of N. L. Prokhorov, V. K. Rayev and Yu. V. Fedotov, of M. A. Rozenblat and A. A. Rubchinskiy, and of V. I. Potanov, G. F. Nesteruk and V. F. Nesteruk were devoted to important questions in increasing the speed of bubble domain storage devices.

The principles of construction of bubble domain stores with arbitrary access and internal address decoding were examined by V. B. Smolov, L. V. Glovatskiy, A. A. Zel'din and L. A. Shumilov.

The results of investigations of thin magnetic films with micron and sub-micron bubble domains were contained in the reports of A. V. Antonov, N. Yu. Gunev and V. Yu. Il'in, of L. I. Koshkin and Yu. P. Zubkov, of F. S. Kichmarenko, A. S. Komalov, Ye. V. Babkin and V. G. Pyn'ko, of S. A. Astashkin, Z. M. Bruk, V. V. Osiko, V. I. Smokin, Yu. V. Starostin and M. I. Timoshchechkin.

Methods of determining lamination in films of Bi-containing ferrite garnets were examined in the report of I. G. Avayeva, F. V. Lisovskiy, Ye. S. Mansvetova, A. M. Balbashov, A. Ya. Chervonenkis and N. L. Shupegin.

Investigations of the temperataure dependence of magnetic anisotropy and coercive force in garnet films were discussed by V. A. Yatsenko, V. A. Bokov, M. V. Bystrov Ye. S. Sher and T. K. Trofimov, and in amorphous films by V. F. Bochkarev, V. G. Baryshev and S. V. Grudinin.

The reports of V. F. Maliy, A. M. Afonin, Yu. I. Vakhrameyev and V. A. Yakovlev and of V. I. Zhilin and V. A. Potakova were devoted to the physics of processes of remagnetization in multilayered epitaxial films.

The results of investigation of the domain structure of epitaxial ferrite-garnet films in strong magnetic fields (up to 150 kilooersteds) in the vicinity of lines of phase transitions of the second kind were presented in the report of I. Ye. Dikshteyn, F. V. Lisovskiy, Ye. G. Mansvetova, V. V. Tarasenko, V. I. Shaposalov and V, I. Shcheglov. The reports of V. G. Kleparskiy, of S. Ye. Yurchenko, and of L. P. Ivanov and G. A. Nepokoyshitskiy were devoted to the investigation of the mobility of domain walls by various methods. V. A. Bokov, V. V. Volkov, V. I. Karpovich, T. K. Trofimova and Ye. S. Sher examined the influence of the parameters of materials on the velocites of domain walls, and A. S. Loginov, G. A. Nepokoychitskiy and A. T. Morchenko reported on distinctive features of the switching of the direction of distortions of form of bubble domains in pulsed advancing magnetic fields.

The reports of Ye. I. Il'yashchenko, S. N. Matveyev, N. I. Karmatskiy and Ye. P. Parinov, and of V. G. Kleparskiy and A. M. Romanov were devoted to investigations of physical processes taking place during the control of bubble domains and to determination on the basis of them of the optimum designs and parameters of control elements for large-capacity bubble domains. O. A. Tsyganov presented a report on

",athematical simulation of the quasistatic interaction of bubble domains and periodical controlling coatings," and S. N. Smirnov examined a method of simplified analytical and graphic representation of the work of bubble-domain circuits with variation of the bubble domain radius taken into consideration.

N. P. Vasil'yeva presented a survey of the status of work on the theory and construction of stores with information carriers in the form of "flat" magnetic domains (PMD), giving special attention to the prospects of increasing the information density and technological level of PMD-devices.

Magnetic materials fof PMD-devices and the conditions of formation of low-coercive channels were discussed in the reports of N. G. Reshetnikova, V. V. Myakhar, G. T. Samsonova, A. T. Nabatov and T. S. Pyn'ko, of Yu. S. Kulikov and F. A. Gal, of V. E. Osukhovskiy, V. I. Malyutin and L. S. Shushpanov, of V. A. Seredkin, G. I. Frolov and V. S. Zhigalov, and of L. S. Palatnik, L. Z. Lubyanyy, L. I. Lukashchenko and S. T. Roshchenko.

V. S. Semenov, in a report entitled "On the question of domain wall energy," showed the incorrectness of the unidimensional model of the Blokh wall in the examination of thick walls. Questions of the stability of PMD's, which determines the structural parameters and density of arrangement of PMD's in a storage medium, were thoroughly analyzed in the report of N. P. Vasil'yeva and V. S. Semenov. The report "The dependence of the output signal and the velocity of PMD's on the width of the readout channel in a PMD store," was presented by O. A. Sedykh and O. M. Fioshkin, and the results of the development of a method of investigating displacements of PMD's with controllable intensity of the domain walls were examined by F. A. Gal and V. I. Malyutin. The reports of S. I. Kasatkin, of A. S. Apival, A. A. Faktorovich and L. S. Sheykis, of A. G. Yezupov, V. M. Zuyev, T. K. Krakau, M. G. Petrushina, S. I. Selivanov and K. I. Smirnov were devoted to the development and planning of PMD-devices.

Questions of thermomagnetic recording and materials for it were examined by G. A. Govor, G. I. Makovetskiy and A. N. Medvedev in the report, "Magnetic properties of manganese arsenide thin film, an information carrier," by B. M. Abakumov, N. D. Baykova, M. L. Gurar', Ye. N. Il'icheva, Yu. N. Fedyunin and A. G. Shishkov in "Conditions of thermomagnetic registration of holograms on MnBi films," B. M. Abakumov, A. B. Granovskiy and V. A. Pogozhev in "Quasistatic and pulsed 90-degree remagnetization of Permalloy films with a banded domain structure," L. I. Koshkin, V. N. Kokot'ko and B. V. Khramov in "On the possibility of thermomagnetic recording of information on ferrite stripe-films in a field of anisotropy"; by A. D and V. D. in a report entitled "Magneto-optical properties of bubble domains in thin monocrystalline magnetic semiconducting films." Distinctive features of the recording of information on garnet film in a two-layer thin-film magnetic structure were discussed by A. P. Gubarev and A. M. Balashov. Magneto-optical effects in amorphous films of GdFe with amall additions of Bi were the subject of discussion in the report of G. F. Dolidze, O. I. Bakradze, D. V. Yakashvili, I. M. Dzhobav and G. I. Dzhordzhishvili. The graphic-analytical method of optimizing an active medium on Bi-containing garnet films with application to thermomagnetic recording of information was examined by A. Ya. Chervonenkis, Ye. M. Sol'nikova and V. I. Rybak.

Yu. M. Shcherbakov, R. I. Tagirov and O. F. Denisov presented a report entitled "The influence of temperature on the effectiveness of readout of information registered on MnBi magneto-optical films."

In the "Stores" section questions of the mathematical simulation of the work of a magnetic central storage for the purpose of estimating the region of stable work were examined in the reports of V. Ye. Zhuk and Yu. V. Drobotov and of Ye. Ye. Zav'yalov, V. I. Zuyev and A. V. Lapshin. Yu. I. Shoyfer, V. V. Bardizh and Yu. P. Pogribnoy discussed the application of "ratchet-recording" on biaxial stores. The development of semi-constant cylindrical magnetic film stores with a capacity of 8 Kbytes was reported by G. M. Nurmukhamedov, V. V. Saltykov, A. N. Starshinov, I. N. Sukhoverkov and V. V. Kostylev. The reports of E. R. Piliposyan and G. Kh. Plavchyan and of M. Kh. Stepanyan and E. R. Piliposyan were devoted to questions regarding the influence of working conditions on the characteristics of cylindrical magnetic films and methods of checking their working capacity.

Questions of the further development of stores based on circular microcores with diameters of 0.4 mm or smaller, the formation of a ferrite field, broaching, etc, were discussed in the reports of S. S. Abaturov, Ya. M. Bekker, I. G. Vasilenko, B. D. Platonov and E. P. Tvelenev; Ya. M. Bekker and P. P. Myagkonosov; A. R. Dul'chyus, K. M. Ragulskis and M. I. Chel'diyev; Yu. Yu. Getsevichyus, A. Yu. Fedaravichyus, M. I. Chel'diyev and G. L. Kul'vets.

M. G. Gessen, N. D. Frolov and Ye. G. Yakushenko examined distinctive features of the distribution of the readout emf in magnetic ferrite plates determined by the homogeneity of the chemical and granular composition and the porosity of the plate. A. O. Timofeyev, V. A. Kulikov and A. Kh. Abdulkhalek reported on investigation of transfer of the magnetic flux along the chain of apertures in a ramified magnetic core.

V. M. Zuyev, T. K. Krakau and K. I. Smirnov reported on automation of the manufacture of coils of magnetic functors based on magnetic ring-shaped cores.

A number of reports were devoted to the principles of construction of integrated magnetic-semiconductor circuits of a "matrix" based on multiaperture ferrite plates and their application (Yu. A. Popov; V. V. Yesipov, Yu. A. Popov, O. N. Golotyuk, S. I. Skvortsov and M. A. Fomin; A. A. Lyubomudrov).

In the "Magnetic recording" section the physical aspects of magnetic recording, magnetic heads and other problems in making mobile magnetic carrier stores, which are an important and promising kind of store for data processing systems, were discussed. Yu. A. Storozhuk, Yu. P. Orlovich and A. P. Stakhov constructed algorithms for the simultation and analysis of a digital magnetic recording. Distinctive features of the application of materials for magnetic recording and methods of their investigation were examined in the reports of L. K. Safronov and V. A. Slayev; V. K. Grigorovich, V. I. Parkhomenko and I. P. Polyukhova; T. G. Dzagurova, N. K. Yakobson, I. I. Eliasberg and O. I. Filatov. N. I. Shpin'kov and V. B. Sokolov reported on the reasons for dispersion of magnetization in particles of CrO_2 of the working layer of magnetic tapes, caused by distortion during the recording and reproduction of information.

The reports of S. K. Kaushinis and A. S. Valis, Yu. Yu. Getsevichyus; Yu. I. Mikelaytis; F. I. Paknene, etc, were devoted to electromagnetic systems for selecting the information of external stores and investigating the dynamics of disk carriers in order to improve them.

In the section on "Magnetic measurement, functional and force converters" A. A. Lipman and V. S. Churikov discussed the creation of magnetic-semiconductor functional elements based on voltage-frequency converters made in the form of an integrator with pulse feedback.

A group of reports was devoted to the development of converter-sensors with use of conditions of hysteresis-free magnetization to enhance senstivity (P. P. Voronichev; A. K. Malina, L. V. Oleynikova and V. P. Kholodkov; V. M. Bladyko; V. G. Gusev, M. P. Ivanov and V. B. Maleshin) for devices for monitoring the direct and alternating currents, the state of insulation of the electric networks, etc.

M. P. Vasil'yev, V. G. Ivkin and Yu. M. Fedorishin discussed a multichannel measurement converter of signals based on an amplifier with a magnetic modulator with zero drift of not more than 0.12 microV/°C. A method of synthesizing the structure of magnetic pulse-width modulators of stabilized pulse converters was proposed in the report of V. V. Sazonov and V. T. Barabash. The results of the investigation and development of magnetometers and ferrosondes for various instruments were reported by M. B. Mal'tsev and V. P. Mel'nikov; V. P. Korotkin (thin-film magnetometers); V. B. Kravchenko, A. A. Lipman and A. I. Pirogov; G. N. Kovshov and B. V. Lavrov; A. M. Chernyy and A. S. Nagaykin.

S. A. Belonogov discussed ways to enhance the sensitivity of quantum sensors of magnetic flux on the basis of the Josephson effect for measurement of weak magnetic fields.

Thermomagnetic elements and their application were the subject of the reports of I. Yu. Petrov and Yu. A. Aznabayev, and of A. M. Litvenenko.

In a number of reports presented in that section various questions about the theory and development of power magnetic elements were discussed. Yu. V. Lobanov, L. I. Gutin, I. R. Ishakov and E. M. Nazarov reported on the development of a thyristor frequency converter with a magnetic regulating element with a capacity of 100 kW and a frequency of 8 kHz. Magnetic-valve direct current sources with a regulator based on a saturation valve with deep current regulation were examined in the report of V. P. Obrusnik and A. D. Silkin. R. A. Akhmerov and T. I. Popov told about the development of an autotransformer converter of the number of phases of magnetic-thyristor frequency multipliers and regulators of three-phase voltage. Distinctive features of the design of pulse transformers with a working temperature of about 673°K were discussed in the report of L. E. Roginskiy, S. V. Shapiro, G. A. Kuzin and B. I. Malkin.

In the section "Magnetic materials, cores, magnetic measurements and processes of remagnetization" much attention was given to developments of new and improved magnetic alloys and films. T. I. Shcherbakov, M. B. Tsal'kova and V. V. Sosnin reported on the development of a new low-noise magnetically soft alloy 82 NMP with a high degree of hysteresis loop rectilinearity and a small coercive force (0.015 Oe for a tape thickness of 0.02 mm). The reports of V. N. Veselkova, L. B. Popova, A. I. Kirshin and M. Sh. Barenboym; A. I. Zusman and Z. M. Istratova (alloys with low residual induction); A. M. Zimichev, N. V. Monakhova and V. V. Sosnin were devoted to the application of thermomagnetic processing and other technological improvements to obtain magnetic alloys with improved and special characteristics. V. V. Molotilov, V. V. Sosnin, G. A. Zaytseva, V. F. Larskiy, Yu. L. Bormotov and

R. D. Nuraliyeva discusssed new two-phase magnetic materials with a displaced partial hysteresis loop and possibilities of their application in magnetic elements.

Much interest was aroused by the survey report of I. M. Puzey on the present status and prospects of application of amorphous alloys and the report of Yu. I. Gratsianov, G. A. Zaytsev, B. N. Kulagin, B. V. Molotilov, V. V. Sosnin and L. G. Nekhayev on a highly permeable amorphous alloy.

Questions of measurementa and automation of the monitoring of magnetic properties of materials and cores were discussed in the reports of A. V. Trushkov, S. S. Grigor'yev and Yu. S. Dymchenko; Ye. F. Berezhnov and V. D. Shashko; R. P. Petkevichyute and V. L. Ragul'skene; V. M. Sidorov and Yu. A. Nezamayev; V. S. Malyshev, G. V. Domayev, M. D. Vorob'yev and S. G. Mashkovich, etc.

Various aspects of remagnetization processes were examined in the reports of A. G. Shishkov, Ye. N. Il'icheva, N. G. Kanavina, A. I. Pirogov, V. D. Khodzhayev and V. I. Yazovtsev (local processes of remagnetization of thin-film elements of various configurations); A. S. Abramov and V. E. Osukhovskiy (application of remagnetization in a slipping conditions to reduce magnetic noise of magnetic films); O. S. Kolotov (investigation of the internal field arising during pulsed remagnetization of polycrystalline ferrites); A. K. Malin, V. I. Lachin, V. S. Fediy and V. I. Kholodkin (hysteresisfree magnetization); F. I. Pashkovskiy and Yu. M. Shamayev (influence of interdomain interaction on symmetric partial hysterisis loops of ferrite cores); Ye. G. Sanoyan and K. A. Yegiyan (displacement of hysteresis loops in two-layered films consisting of magnetically soft and hard layers); P. I. Boroday, V. V. Karasev and Yu. A. Shusherov (consideration of viscosity and eddy currents).

I. V. Ivanova, A. I. Drokin and T. N. Metlyayev discussed the thermomagnetic effects of ordering in lithium-cobalt ferrites and their influence on magnetic properties. S. I. Kort, A. P. Tikhonov, V. I. Yanyuk, M. M. Chervinskiy and S. F. Glagolev analyzed errors of measurement of specific magneto-optical Faraday rotation in thin magentic films. V. V. Yudin, G. V. Kozodoy and P. N. Kornyushin examined methods of possible parametrization of the thin magnetic structure of highly dispersed films.

In the concluding, plenary session, section chairmen Ye. I. Il'yashenko, V. V. Bardizh, V. G. Korol'kov, M. F. Zaripov and A. I. Pirogov summed up the results of work of the sections. It was noted that the contents of reports presented at this conference testify to an unceasing development and improvement of magnetic technology. Important results have been obtained in inporving the characteristics of ferromagnetic materials and new alloys and a technology for the production of ultrathin magnetic tapes, ferrites and films with various physical properties. The reports presented at this conference were devoted mainly to the most promising directions of the development of magnetic technology, as is evidenced, for example, by the fact that about 40 percent of the reports were devoted to such new and promising devices as domain and magneto-optical storages. Considerable development has been obtained by theoretical and experimental investigations of the main physical phenomena used for the construction of various types of magnetic elements, including investigations of the processes of domain wall motion, pulsed and high-frequency remagnetization and hysteresisfree magnetization.

The main scientific problems of great importance for the future development of magnetic technology were recorded in the resolution of the conference.

[69A-2174]

2174
CSO: 1863

PUBLICATIONS

TABLE OF CONTENTS FROM THE COMPUTER JOURNAL 'CYBERNETICS'

Kiev KIBERNETIKA in Russian No 6, Nov-Dec 80 signed to press 19 Dec 80 p 148

[Text] Table of Contents

Brief Communications

Scientific Information

Reviews of New Books

[101-8225]

8225
CSO: 1863

ABSTRACTS FROM THE JOURNAL 'CONTROL SYSTEMS AND MACHINES'

Kiev UPRAVLYAYUSHCHIYE SISTEMY I MASHINY in Russian No 6, Nov-Dec 80 pp 145, 147, 149, 151

UDC 338.984

DISPLAN--A NEW PLANNING TECHNOLOGY

[Abstract of article by Glushkov, V. M.]

[Text] The bases of a new man-machine technique for compilation and optimization of plans in territorial-sector profile, the basis of which is the principle of sequential aggregation of norms jointly linking all levels of planning and the principle of statistical design of dynamic models, are outlined. An essentially new approach to multicriterion optimization of plans is used which includes not only selection of the point in the permissible range but also purposeful control of the restrictions which control this range.

UDC 65.012.2

FORMING AN ENTERPRISE PRODUCTION PROGRAM BY SEVERAL CRITERIA USING THE DIALOGUE PROCEDURE

[Abstract of article by Voynalovich, V. M., Dush, O. N. and Yefetova, K. F.]

[Text] The possibilities and features of using the dialogue procedure for solving the multicriterion problem of linear programming to form an enterprise production program with regard to several indicators are considered. The results of planning decisions for a specific enterprise are presented.

UDC 681.332.3

PROBLEMS AND METHODS OF TECHNICAL REALIZATION OF HIGH-OUTPUT COMPUTERS BASED ON LCI

[Abstract of article by Przhiyalkovskiy, V. V., Lomov, Yu. S. and Fayzulayev, B. N.]

[Text] The optimum relationships between the main parameters of the component and structural base of universal high-output computers are determined as a function of the level of development of microcircuit LSI technology and the main methods of developing the internal structure of this class of computers are formulated.

UDC 691.327

CONSTRUCTION OF ON-LINE AUTOMATIC MICROPROGRAM MACHINES BASED ON PROGRAMMABLE LOGIC MATRICES

[Abstract of article by Buzunov, Yu. A. and Shipilov, N. N.]

[Text] Comparative analysis of different models of on-line automatic microprogram machines is presented from the viewpoint of realizing them on programmable logic matrices. A model of these automatic machines is proposed which most fully corresponds to the restrictions placed on the parameters of programmable logic matrices. A method of constructing automatic tables by special graph-schemes of algorithms is briefly outlined which eliminates the complex procedure of joining them.

UDC 681.327.023

REALIZATION OF COMBINATION CONVERSION BY LARGE INTEGRATED CIRCUITS

[Abstract of article by Gramolin, V. V., Persheyev, V. G. and Shamrov, M. I.]

[Text] The features of designing combination conversions based on LCI circuits of ROM, PLM and microprocessors are considered. Versions of the block diagrams and programs for combination conversions of large dimensionalities are presented.

UDC 681.3.025

INVESTIGATING THE EFFICIENCY OF COMPUTER STRUCTURES WITH BYTE ORGANIZATION

[Abstract of article by Gerbali, S. N. and Fedorovich, O. Ye.]

[Text] The efficiency of structures with byte organization is investigated on the basis of simulation modelling of instruction flow. The effect of the width of instruction sampling on the productivity of the computer structure is evaluated. The results of modelling structures with byte organization are presented and analyzed.

UDC 681.32

A HIGH-SPEED MULTIMICROPROCESSOR COMPUTER SYSTEM FOR SOLVING SYSTEMS OF ORDINARY DIFFERENTIAL EQUATIONS

[Abstract of article by Zhabin, V. I., Korneychuk, V. I., Tarasenko, V. P. and Shcherbina, A. A.]

[Text] A method of parallelling the process of solving systems of ordinary differential equations is considered which permits time combination of processes of system integration at several points. A multimicroprocessor computer system for realizing it is proposed.

UDC 681.3.01

A METHOD OF SIMPLIFYING ADDRESSING OF OPERANDS WHEN EXECUTING FFT ALGORITHMS WITH ARBITRARY BASES

[Abstract of article by Kolomeyko, V. V.]

[Text] It is suggested that the unified method of calculating the addresses of variables and coefficient indices be used for a large number of fast Fourier transform (BPF) algorithms with arbitrary bases. It is shown that the given method can be used when executing BPF algorithms both with digital computers designed for spectral analysis of signals and when using general-purpose computers having no specialized addressing devices.

UDC 681.3.05

METHOD OF ADAPTIVE REDUNDANCY IN DIGITAL DISPLAYS

[Abstract of article by Derkach, V. P. and Smolyarov, A. M.]

[Text] A method of adaptive redundancy in digital displays, based on the use of internal structural redundancy, is described. The components of mosaical matrix displays free of execution of given functions at a given moment are connected as reserve components due to shifting of the total or partial image on the screen. Calculating relations are presented for analyzing the reliability indicators.

UDC 681.3.053

P-TECHNOLOGY-80

[Abstract of article by Vel'bitskiy, I. V.]

[Text] The current state of the art and trends for further development of the P-technology of programming and means of maintaining it--RTK production complexes--are shown.

UDC 681.325.53

A METASYSTEM FOR SUPPORT OF PROBLEMS-ORIENTED LANGUAGES AND A TECHNIQUE OF USING IT

[Abstract of article by Sinyavskiy, A. L., Kholodenko, O. A. and Yalovenko, N. L.]

[Text] A parametric system of constructing metatranslators MT is considered and its structure and the capabilities of conducting a dialogue are described. The MT system has means at its disposal for development not only of language translators, but also to develop a system for teaching this language and a program-debugging system based on it.

UDC 681.322

A METHOD OF CONSTRUCTING A PROBLEMS-ORIENTED PROGRAMMING SYSTEM

[Abstract of article by Bayushev, N. K.]

[Text] One of the methods of constructing a problems-oriented programming system is considered. The requirements realized in design of the system are outlined and a translation algorithm is proposed. The method is checked during development of the system oriented toward data processing in accounting problems of ASUP [Enterprise automated management system].

UDC 681.3.05

FACILITIES FOR OPERATING WITH STRUCTURED DATA IN COMPUTER NETWORKS (REVIEW)

[Abstract of article by Glushkov, V. M., Stogniy, A. A. and Bazilevich, I. A.]

[Text] It is shown that further success in development of the data processing industry is related to development and introduction of distributed data base systems, the main distinguishing feature of which is data distribution in computer network nodes. Various approaches to developing operating facilities with distributed data are considered: distributed execution of requests, synchronization of data variation, distributed description of data, integration of inhomogeneous data bases and so on. A survey of some systems developed by leading foreign companies is given.

UDC 62-50:681.3.06

A STANDARD AUTOMATED CONTROL SYSTEM PROCEDURE IN THE OKA MEDIUM DATA BASE MANAGEMENT SYSTEM AND EXPERIMENTAL ANALYSES OF ITS EFFICIENCY OF IMPLEMENTATION

[Abstract of article by Mandrusova, G. P., Manovich, S. F., Medvedeva, N. M. and Karatayeva, N. B.]

[Text] The general principles inherent to OKA data base control systems are analyzed on the example of the procedure for calculating the total compatibility of parts and assembly units in the product. The experimental characteristics of operating time are presented and analyzed.

UDC 51;681.3.06

MEANS OF MAJOR PIPELINE OPTIMIZATION IN THE REGENT RELATIONAL REPORT GENERATOR

[Abstract of article by Bezrukov, N. N.]

[Text] The structure of REGENT language operators, which provides execution of several operations on homogeneous files without formation of intermediate disc files, is described. Structures for transmission of files by name, i.e., in the form of a dynamic sequence of notations transmitted for subsequent processing, are proposed.

UDC 681.3.06

EXPANDING THE FUNCTIONAL CAPABILITIES OF INFORMATION SORTING ON COMPUTERS

[Abstract of article by Nikitina, R. I.]

[Text] Problems of expanding the functional sorting capabilities on the Minsk-32 computer are considered. The algorithm of the SORTL program--the main component of the system--is presented.

UDC 681.3.06

DETERMINING THE OPTIMUM TREE FOR FINDING DATA IN INFORMATION SYSTEMS

[Abstract of article by Kolesnikov, V. V.]

[Text] Postulation of the problem and formulas are presented for determining the optimum search (catalog) tree in a K-step search for data in any information systems. Two optimization criteria--average time and average cost of searching for a single information object--are considered.

UDC 681.3.021

ORGANIZATION OF MACHINE DOCUMENT STORAGE ON EXTERNAL MAGNETIC CARRIERS

[Abstract of article by Finikov, V. A.]

[Text] One of the possible versions of organizing archives based on external magnetic tape and magnetic disc carriers is described and the software which organizes this archive and which provides the required set of operations with the documents is presented.

UDC 681.3.02

FORMALIZING THE STRUCTURE AND INTERACTION OF SUBSYSTEMS OF A RADIAL INFORMATION-COMPUTER SYSTEM

[Abstract of article by Pavlov, V. P.]

[Text] A radial information-computer system consisting of local subsystems of upper and lower levels of control is considered and described. The information flows of the nucleus of the system and of local subsystems are described. The main expressions which describe the structure of the IVS [information-computer system] and interaction of the local subsystems which may be the basis for analysis of the developed information-computer systems are presented.

UDC 681.3.06

AUTOMATED FLIGHT TEST DATA PROCESSING SYSTEM (TEMP)

[Abstract of article by Skurikhin, V. I., Mironov, A. D., Kvachev, V. G., Makhon'kin, Yu. Ye., Nikitin, A. I., Pavlova, Z. A. and Fil'kov, A. I.]

[Text] An automated flight test data processing system based on the use of third-generation computers (YeS EVM [Unified computer system] and ASVT-M [Modular system of computer technology]) is described. The feature of two-level configuration of the system, the hardware and software composition and also the data processing technology in the system are considered.

UDC 62-50:681.3.06

AUTOMATED VIBRATION TEST CONTROL SYSTEM TEST

[Abstract of article by Kuntsevich, V. M., Dekhtyarenko, P. I., Krementulo, Yu. V., Raykhman, S. R. and Abramovich, S. V.]

[Text] A description, operating conditions, main specifications and the results of testing the TEST system, designed to conduct bench vibrational tests of articles of new equipment, are presented.

UDC 681.3.06

DIGITAL ANALYSIS OF SIGNALS IN EXPERIMENTAL DATA PROCESSING SYSTEMS

[Abstract of article by Korniyenko, G. I., Dianov, V. I. and Dianov, M. I.]

[Text] Problems of processing signals using the data storage mode for subsequent detailed calculation of the static and dynamic characteristics of processes are considered. Main attention is devoted to data storage on an external carrier in the form of a common data file, to execution of preliminary processing of signals, to calculation of their static, dynamic and joint characteristics and so on.

UDC 681.3.02

RECORDING OF PERIODIC AND QUASI-PERIODIC HIGH-FREQUENCY PROCESSES IN SYSTEMS FOR AUTOMATION OF SCIENTIFIC AND TECHNICAL EXPERIMENTS

[Abstract of article by Solozhentsev, Ye. D. and Malyarenko, V. A.]

[Text] Various circuits for recording quasi-periodic high-frequency processes in systems for automation of scientific and technical experiments are analyzed. The properties and errors of an asynchronous circuit for recording quasi-periodic processes with a phase meter are considered. Data of a developed technical device are presented.

UDC 681.3.06

THE SOFTWARE FOR A MULTIUSER SYSTEM FOR AUTOMATION OF SCIENTIFIC EXPERIMENTS BASED ON MINOCOMPUTERS AND CAMAC

[Abstract of article by Karasev, V. M., Koroleva, R. A., Lastochkin, N. K. and Tyurin, A. V.]

[Text] The software of a multiuser system for automation of scientific experiments based on the M6000 computer and the multicrate system CAMAC is described. The software structure of the system is presented and the functioning of individual program subsystems is described.

UDC 530.16

THE STOCHASTIC MODEL OF QUARTERLY-MONTHLY PLANNING OF PIPE PRODUCTION

[Abstract of article by Vaynzov, A. M., Yanovchik, V. A. and Kupershteyn, Ye. A.]

[Text] The stochastic model of volume-calendar planning of pipe production, for implementation of which a stochastic quasi-gradient algorithm is proposed, is considered. A method of selecting the penalty factors for pipe production is suggested.

UDC 681.3.06

THE PROLOG-ES SYSTEM AND TRAINER IMPLEMENTATION

[Abstract of article by Branovitskiy, V. I., Kudryavtseva, S. P. and Seraya, V. V.]

[Text] General data on PROLOG language (the input language of the PROLOG-ES system) are described and its characteristic features which permit use of the PROLOG-ES system for simulation and implementation of trainer software are described. Generalized functional schemes of the software of some trainer groups are considered and the prospects for use of the PROLOG-ES system to implement them are shown.

UDC 681.3.06

MODEL-BASED ADAPTIVE TEACHING SYSTEM

[Abstract of article by Ziders, Ya. E., Rastrigin, L. A. and Erenshteyn, M. Kh.]

[Text] An adaptive teaching system using a computer is proposed, the basis of which is a teaching algorithm which uses a model of the student. The system was used for the problem of memorization of foreign vocabulary and teaching the understanding of foreign texts.

UDC 681.32

YES1060 COMPUTER CHECKING, DIAGNOSIS AND RESTORATION FACILITIES

[Abstract of article by Volkov, A. P., Mikhaylov, I. B. and Khramtsov, I. S.]

[Text] The designation and structure of hardware, microprogram and software of the YeS1060 checking, diagnosis and restoration facilities are considered. Some problems of the technology of developing these facilities--the symbolic language of MD-60 microtests and a system for generation of SGMT microtests--are outlined.

UDC 681.327.11

PLANE TABLE FOR READING AND CONVERSION OF GRAPHICAL INFORMATION WITH EXPANDED FUNCTIONAL CAPABILITIES

[Abstract of article by Zabara, S. S., Sakharin, V. G. and Sofiyuk, A. A.]

[Text] A plane table for reading and conversion of graphical information, used in systems for automated design of electronic assemblies and having expanded functional capabilities is considered. The main characteristics, designation, compositions and features of constructing the assemblies and blocks of the device are presented.

[102-6521]

CSO: 1863

REGULAR STRUCTURES FOR AUTOMATON CONTROL

Moscow REGULYARNYYE STRUKTURY AVTOMATNOGO UPRAVLENIYA in Russian 1980 (signed to press 22 Aug 80) pp 2-4, 215

[Annotation, foreword and table of contents from book "Regular Structures for Automaton Control", by Vyacheslav Afanas'yevich Gorbatov, Boris Leonidovich Ostankov and Stepan Alekseyevich Frolov, Izdatel'stvo "Mashinostroyeniye", 1775 copies, 216 pages]

[Text] In this book are discussed new methods of improving the regularity of automata, which are an effective means of improving the reliability, production feasibility and economic efficiency of digital equipment. Major attention is paid to reducing the labor intensiveness of searching for optimal regular structures for the automaton operator on the basis of the principles of characterizational control.

This book is intended for engineers involved in designing modern digital systems.

Foreword

In the historical decisions of the 25th CPSU Congress much attention was paid to hastening scientific and technical progress, to the intensification of production and to a growth in labor productivity as one of the key factors in further improvement of the well-being of the Soviet people. The degree of automation and mechanization of production processes determines labor productivity to a great deal. Typical problems in modern industrial production are problems relating to the logical control of equipment [18]. Such problems arise, for example, in automating the cold processing of metals in machine building, in controlling furnaces and rolling mills in the metallurgical industry, etc. Furthermore, requirements for the precision of control grow in proportion to improvements in technology and an increase in the intensification of production, which in turn causes a growth in the dimensionality of mathematical models used for a formal description of the process, and an increase in the complexity of computations in finding an optimal control vector. Added to these problems in implementing a control system in an analog variant are heightened requirements for the precision of fabrication of components of the control system. All this has been responsible for a heavy extension of the employment of the digital variant of implementing a control system.

In the digital variant the main abstract model used in designing the control system is the automaton. Much research, both by Soviet and foreign scientists, has been devoted to various aspects of this kind of control, which below we will call automaton control; for example, V.I. Varshavskiy [2, 7], M.A. Gavrilov [8], V.M. Glushkov [9], V.G. Lazarev [27], A.N. Melikhov [29], D.A. Pospelov [34], V.N. Roginskiy [35], S. Anger [1], R. Miller [30], etc.

Requirements for the high quality of automaton control devices, machines and systems to be created and development of the integrated technology principle have brought to the forefront the problem of improving the regularity of control systems, i.e., the problem of increasing the percentage of equipment containing regular structures, such as homogeneous media, programmable logic arrays, registers, counters, adders, etc.

Improvement of the regularity of an automaton consisting of two blocks--a logical processor and a memory--consists in implementing the first of these blocks in the form of homogeneous structures or programmable logic arrays and including in the second counters, registers, adders or other regular structures.

This book is devoted to a study of regular structures for automaton control. In the first three chapters is discussed the design of logical processors consisting of programmable logic arrays, and here is used the machinery of the density analysis of "mographs" [model graphs] and the theory of characterizational control suggested by V.A. Gorbatov [12, 14, 19]. The last two chapters are devoted to improving regularity of the automaton's memory. This improvement is achieved by organizing the memory in the form of mutually disconnected blocks, each of which is implemented in the form of a multistable memory cell.

CONTENTS

[117-8831]

8831
CSO: 1863

SELECTION AND APPLICATION OF SYSTEMS OF COMPUTER LOGIC ELEMENTS

Moscow VYBOR I PRIMENENIYE SISTEM LOGICHESKIKH ELEMENTOV EVM in Russian 1980 (signed to press 30 Sep 80) pp 2-4, 73

[Annotation, foreword and table of contents from book "Selection and Application of Systems of Computer Logic Elements", by Konstantin Andreyevich Sapozhkov, Aleksandr Moiseyevich Bershadskiy and Vadim Borisovich Patz, Izdatel'stvo "Energiya", 10,000 copies, 73 pages]

[Text] Questions relating to the selection and application of systems of logic elements (SLE's) are discussed. The principles of evaluating the quality of SLE's and approaches to evaluating quality in relation to various conditions and comparison objectives are discussed. A demonstration is given of the use of quality estimates for the optimal design of equipment employing SLE's. Recommendations are given on the optimal design, employing SLE's, of computer technology and discrete automation equipment.

For specialists working in the area of computer technology and discrete automation, as well as for upper-class students at higher educational institutions specializing in this field.

Foreword

In computer technology, radio electronic and discrete automation equipment is used a great number of types of logic circuits, which is increasing steadily. Logic circuits (elements) and systems of logic elements differ in utilization data (range of working temperatures, relative humidity, vibration in a specific range, repeated shocks with acceleration, line loads with acceleration, ambient pressure), electrical parameters, structure of the system, design, etc. The considerable amount of different types of systems is explained by the diversity of requirements for equipment and the aspiration of creating equipment with the best technical and economic characteristics. The diversity of types of logic circuits has made topical the problem of comparing them and selecting the most suitable (optimal) ones for constructing a specific piece of equipment.

This job is rather labor intensive and complicated. Firstly, in comparing several systems (complexes, series) of logic elements identical in purpose certain difficulties arise in drawing a final conclusion regarding the advantages of one of the systems considered over the others, since systems having advantages with regard to all parameters selected (criteria for comparison) are encountered rather infrequently. As a rule, having an advantage with respect to one or more parameters, a given system is inferior to other systems with respect to the others.

Secondly, systems of logic elements (SLE's) can be characterized by various parameters of a sort that are characteristic of one SLE but are not important for another. In the majority of cases SLE's consist not of a single element, but of a certain set, and these sets and the total number of elements can differ considerably in various SLE's.

The presence in an SLE of elements differing in technical characteristics and logic functions or only in logic functions (for example, in the majority of logic series elements implement different variants of logic functions) makes it possible in designing equipment to consume a smaller number of circuits, i.e., to improve the technical and economic characteristics of the equipment. The characteristics (parameters) of SLE's can be divided arbitrarily into two groups. Under the heading of the first group come characteristics determined directly from the technical documentation for SLE's and relating to the entire SLE as a whole. Under the heading of the second come characteristics which are determined not only by the parameters of the SLE, but also by the parameters of the equipment constructed by means of the SLE in question. For example, under the first group can come resistance to mechanical and climatic influences and to deviation in the parameters of elements, power supply requirements, load capacity, complexity, etc. Under the second, reliability, power requirement, speed of response, cost, size, weight, and the like. All this makes it necessary in comparing a great number of SLE's to resort to methods of simulation and to the use of computers.

In this book are discussed only SLE's with an integrated design (low level of integration), since they are most widely used. However, the procedure for comparative analysis and the criteria are suitable for comparing SLE's employing discrete radio parts.

In comparing SLE's various raw data can be available and various comparison problems can be solved according to these data, such as: selecting the most suitable SLE for designing a specific piece of equipment when all or some requirements (technical specifications) for SLE elements have been specified; selecting an SLE for designing equipment of a certain class; selecting an SLE for a specific piece of equipment when requirements for SLE elements have not been specified; comparing SLE's with one another at the design stage or for the purpose of unification.

Closely related to the problem of comparison is a number of problems relating to the application of SLE's. These include primarily calculation of the characteristics of the future piece of equipment on the basis of an analysis of the characteristics of the logic elements included in the SLE, the development of methods of testing SLE's and individual functional units, and also the development of methods of testing equipment constructed by means of a specific SLE which will ensure a specific level of equipment indicators important for a given application.

On the other hand, when a certain SLE has already been selected it is necessary to pay attention to the fact that the results which can be achieved depend considerably on how the SLE is used and to what extent the design basis for it has been adapted, which rules were used for designing the equipment, the timing system and a number of other facts. In other words, the application of SLE's involves the solution of an entire combination of problems and only a successful solution optimal for a specific SLE will make it possible to produce the best possible end results. The authors wish to thank I.G. Yepishin for help in writing chapter 5.

The foreword and ch 1 were written by A.M. Bershadskiy, ch 2 by V.B. Patz, and the remainder together.

Send your comments and remarks regarding this book to the following address: 113114, Moscow, M-114, Shlyuzovaya nab., d. 10, Izdatel'stvo "Energiya".

CONTENTS

[117-8831]

8831
CSO: 1863

PROBLEMS OF RANDOM SEARCHING: QUESTIONS OF STRUCTURAL ADAPTATION

Riga PROBLEMY SLUCHAYNOGO POISKA: VOPROSY STRUKTURNOY ADAPTATSII in Russian No 8, 1980 (signed to press 1 Feb 80) pp 330-331

[Table of contents from book "Problems of Random Searching: Questions of Structural Adaptation", edited by L.A. Rastrigin, Izdatel'stvo "Zinatne", 1200 copies, number of pages not available]

[Text]

CONTENTS

[118-8831]

8831
CSO: 1863

BIDIRECTIONAL SIGNAL CONVERTERS

Riga DVUSTORONNIYE PREOBRAZOVATELI SIGNALOV in Russian 1980 (signed to press 14 May 80) pp 4, 201-203

[Annotation and table of contents from book "Bidirectional Signal Converters", by Evald Khugovich Khermanis and Valdis Garal'dovich Karklin'sh, Izdatel'stvo "Zinatne", 1000 copies, 203 pages]

[Text] The fundamentals of the theory of bidirectional converters of fast electrical signals are discussed. The purpose of these converters is the local processing of signals prior to entry into a computer, for the purpose of economizing on time and equipment and increasing the accuracy of analysis. Occasionally this method is the only means for the proper processing of signals. In bidirectional converters is utilized the fundamental property of parametric systems of losing their stability under the influence of proper control.

Two types of converters are discussed: "signal to instantaneous value of the parametron's reaction," and converters employing comparators with feedback. Mathematical models of converters are established, in the form of differential equations with factors which vary continuously or discontinuously over time. Examples are presented of the practical implementation of converters described by differential equations of the first to third order, as well as examples of the use of converters as integrators with finite limits and as filters with a constant phase-frequency characteristic. Ways are indicated of designing on this basis frequency measuring systems, including systems for measuring single radio pulses. Recommendations are given on the use of these converters in designing analyzers based on Walsh functions and systems for registering one-time processes on the basis of shifted bell-shaped-curve functions.

CONTENTS

[118-8831]

8831
CSO: 1863

ANALOG-DISCRETE CONVERSION OF SIGNALS: CONVERSION OF INTEGRAL CHARACTERISTICS OF WIDEBAND SIGNALS

Riga ANALOGO-DISKRETNYYE PREOBRAZOVANIYA SIGNALOV: PREOBRAZOVANIYE INTEGRAL'NYKH KHARAKTERISTIK SHIROKOPOLOSNYKH SIGNALOV in Russian No 4, 1979 (signed to press 9 Mar 78) pp 146-147

[Table of contents from book "Analog-Discrete Conversion of Signals: Conversion of Integral Characteristics of Wideband Signals", by Latvian SSR Academy of Sciences Institute of Electronics and Computer Technology, Izdatel'stvo "Zinatne", number of copies and pages unavailable]

[Text] CONTENTS Page

[118-8831]

8831
CSO: 1863

UDC 681.58

NEW BOOK ON DATA COMPRESSION DEVICES

Moscow USTROYSTVA SZHATIYA INFORMATSII in Russian 1980 (signed to press 3 July 1980) pp 2-4, 161

[Annotation, foreword, and table of contents of book "Data Compression Devices" by Igor' Semenovich Yeremeyev, "Energiya", 6,500 copies, 161 pages]

[Excerpts] Annotation

This book presents results from the use of peripheral equipment designed to increase the information content obtained from primary sensing units in centralized monitoring and control systems. Basic information on methods of compressing information and means of accomplishing this are given. The author describes the most important components of hybrid information compressing devices, ways to synthesize these devices, and examples of their application in monitoring and control systems.

The book is intended for specialists in computer technology and automatic monitoring and control and may also be recommended to college students in the corresponding specialization.

Introduction

Contemporary technical literature devotes a great deal of attention to methods of constructing automated computing systems. Hybrid (analog-digital) computing systems are one of the areas of development of computer technology.

The use of computing systems in different fields of current science and engineering has led to sharp growth in the volumes of information that can be processed. Along with this there is growth in requirements imposed for the system that processes the information and for the persons who use the results of the information being processed (the system user). This is linked to capabilities for analyzing the information that is processed.

In connection with this, a review of the methods of preliminary processing or compressing information in the stage preceding digital processing by computer is timely. This problem arises in space research, automation of experimental research, and other areas where automated systems for data collection and processing are employed. Because the signals taken from the primary data sensing units are usually analog signals (discontinuous quantities) and data processing is usually done in digital form, data compression devices are usually hybrid analog-digital units.

I. S. Yeremeyev's book "Data Compression Devices" is devoted to questions of constructing hybrid devices that compress data.

Chapter 1 considers purely mathematical methods of compressing information: elements of coding theory, extrapolation and interpolation theory, and regression and factor analysis as well as optimization techniques and the theory of spectral analysis.

It must be said that the theory of coding is generally used today to process digital signals. In the case where analog signals are being processed the mathematical apparatus of continuous logic, or infinite-value logic as it is still called, is applicable. Questions of continuous logic have been dealt with in recent years in the works of Wilkinson, MacNaughton, S. A. Ginzburg, and others.

Chapter 2 considers the elements of data compression devices whose construction is based on hybrid blocks that perform analytic and logical operations and hybrid memory units. The apparatus of continuous logic also is applied in this chapter of the book.

Chapters 3 and 4 give the basic diagrams of data compression devices and review methods of calculating their error. Unfortunately, the book does not consider the use of digital modeling by computer to analyze the error of data compression device units. This technique has been used more and more widely in recent years to analyze hybrid devices.

I. S. Yermemev's book is one of the first to give a systematic presentation of material on the questions of data compression. As a result of this it does not answer all the questions that arise in building data compression devices, but only outlines the basic directions of further research in this field of contemporary computer technology.

The book will be useful to developers of automated systems for data collection and processing, to the users of these systems, and to college teachers and students concerned with computer technology and its application.

P. N. Shinvirev

Table of Contents

[112-11,176]

11,176
CSO: 1863

- END -