JPRS L/8986

20 March 1980

USSR Report

CYBERNETICS, COMPUTERS AND AUTOMATION TECHNOLOGY

(FOUO 4/80)

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APPROVED FOR RELEASE: 2007/02/08: CIA-RDP82-00850R000200060027-4

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CYBERNETICS, COMPUTERS AND AUTOMATION TECHNOLOGY

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DEVELOPMENT AND PRODUCTION OF COMPUTERS AND CONTROL EQUIPMENT

Hardware

USSR UDC 681.51:007.5

A SYSTEM OF GATHERING AND ALGORITHMS OF PRIMARY PROCESSING OF PHOTOMETRIC DATA

Moscow INSTITUT PRIKLADNOY MATEMATIKI AKADEMII NAUK SSSR in Russian, preprint No 87, 1979 34 pp

PLATONOV, A. K. and SOKOLOV, S. M.

[From REFERATIVNYY ZHURNAL: TEKHNICHESKAYA KIBERNETIKA No 11, Nov 79 Abstract No 11.81.362 by G. G. Vaynshteyn]

[Text] Under consideration is a system of gathering photometric data which consists of 100 photoelectric transducers assembled into a matrix of 10x10 elements and connected to an M-6000 small computer. Several algorithms of primary data processing are described which include an algorithm of normalizing the indications of photoelectric transducers with their current-illuminance characteristics taken into account, an algorithm of correcting the indications so as to account for possible faults in the instruments, an algorithm of extracting a straight brightness taper from images with a simplified version of the Huckel operator, and an algorithm of sharpening the contrast by simulation of the "lateral stagnation" effect. The feasibility of extracting two homogeneous regions within the field of vision of the photoelectric matrix by the method of potentials is examined. Research effort underway is oriented toward development of a video transducer for an autonomous moving robot. Figures 25; tables 4; references 11.
[178-2415]

2415
CSO: 1863

USSR UDC 681.51:007.5

A DEVICE FOR AUTOMATIC COUNTING OF OBJECTS ON A PLANE IMAGE

Moscow SBORNIK NAUCHNYKH TRUDOV PO PROBLEMAM MIKROELEKTRONIKI [Problems in Microelectronics, Collection of Scientific Articles] in Russian Izd-vo Moskovskogo Instituta Elektronnoy Tekhniki No 39, 1978 pp 104-112

GRISHIN, M. P.

[From REFERATIVNYY ZHURNAL: TEKHNICHESKAYA KIBERNETIKA No 11, Nov 79 Abstract No 11.81.366]

[Text] A device is described which makes it possible to analyze optical images and count the number of objects within the field of vision as well as the number of internal closed regions within objects. The count depends neither on the dimensions and the shapes of objects nor on their relative disposition within the field of vision. The device is realized with digital engineering components. As the transducer serves an LI-428 vidicon. Figures 3; references 1.
[178-2415]

2415
CSO: 1863

USSR UDC 681.51:007.5:681.327.12(088.8)

A DEVICE FOR CHARACTER RECOGNITION

USSR Patent Class G 06 K 9/00 No 650,087 28 Feb 79 (disclosure No 2,388,895 1 Aug 76)

KOZLOV, L. G., GRITSYK, V. V., ZLATOGURSKIY, E. R., BOYUN, V. P. and CHERCHYK, G. T., Institute of Cybernetics, Academy of Sciences of the Ukrainian SSR

[From REFERATIVNYY ZHURNAL: TEKHNICHESKAYA KIBERNETIKA No 11, Nov 79 Abstract No 11.81.339 P]

[Text] There exists a device for character recognition which includes an objective, a television tube, a video amplifier, arrays of frame and line switches, frame and line distributors, an array of triggers, a classifier module, a changer of coordinates, a control module, a generator of linear voltages, an array of voltage generators and a commutator. The most accurate technical realization of the new concept contains a first memory module connected through a commutator bank to a shift register and to a first array of counters. A second memory module is connected through a shift register to a control module. The purpose of this invention is to make the character recognition more precise and to simplify the device. The purpose is achieved by including a module which classifies the spectra of recognizable characters and connecting it to a second array of counters as well as to the control module. The second array of counters is connected to the first memory module and to the control module. A third array of counters is connected to the second memory module and to the control module. The spectra classifier contains a comparator connected to a register, to a commutator, to a counter and to a first "AND" gate, this "AND" gate being connected to the commutator and to a second "AND" gate which is also connected to the register and to the commutator. Figures 2; references 2. [178-2415]

2415
CSO: 1863

USSR UDC 681.518:519.878

AN ADAPTIVE DEVICE FOR DATA PROCESSING

USSR Patent Class G 06 F 15/20 No 650,081 28 Feb 79 (disclosure No 2,450,686 9 Feb 77)

DUBOVIK, YE. A. and SENTYURIN, V. M., Institute of Electronic Control Machines

[From REFERATIVNYY ZHURNAL: TEKHNICHESKAYA KIBERNETIKA No 11, Nov 79 Abstract No 11.81.705 P]

[Text] The invention relates to the field of computer engineering and telemetry. The closest to it technical realization is an adaptive device for data processing which includes a direct-access memory module, a control module, two commutators, a recording module, a readout module, an arithmetic module, five registers, ten "AND" gates, four counters and two decoders. The first output of the control module is connected to the control input of the first commutator. The second output of the control module is connected through the recording module to the first input of the direct-access memory, whose second input is connected through the readout module to the third output of the control module and whose first output is connected to the input of the first register, while the first output of the latter is connected through the first "AND" gate to the first input of the second register. A basic deficiency of this device is its limited throughput capacity. The purpose of this invention is to increase the speed. Figures 1; references 2. [178-2415]

2415
CSO: 1863

INTEGRATED CIRCUITS FOR COMPUTER APPLICATIONS DISCUSSED

Moscow ANALOGOVYYE I TSIFROVYYE INTEGRAL'NYYE SKHEMY (Analog and Digital Integrated Circuits) in Russian 1979 signed to press 5 Apr 79, pp 136-161

[Excerpt from book by Sergey Viktorovich Yakubovskiy Nikolay Arsen'yevich Barkanov, Boris Petrovich Kudryashov, Lev Ionovich Nissel'son, Mikhail Nikiforovich Topeshkin and Lyubov' Petrovna Chebotareva, Izdatel'stvo Sovetskoye Radio, 68,000 copies, 336 pages]

[Excerpt] 3.7.4. Storage Elements Employing MNOS structures

In all the integrated circuits discussed above, employing bipolar and MOS [metal-oxide semiconductor] transistors, for the purpose of storing information in a storage element the existence of a supply voltage is obligatory. When the power is cut off information is lost. However in a number of cases it is necessary to cut off the power, and in addition the ability to store information with the power cutoff considerably reduces the mean power required by the storage unit.

An integrated semiconductor structure--an MNOS [metal-nitride-oxide semiconductor] transistor--makes it possible to design a storage unit which retains information when the power is cut off. In MNOS transistors, unlike ordinary MOS structures, between the silicon oxide (SiO_2) film and the metal gate electrode is placed a film of silicon nitride, Si_3N_4. The storage of charges in the region of the Si_3N_4-SiO_2 interface makes it possible to store information when the power is cut off for several years.

The film of SiO_2 prevents the transfer of charges in the absence of voltage in the gate or when it is below the threshold value. This capability of a storage element employing an MNOS transistor is responsible for longterm storage of information when the power is cut off.

Information is stored in a memory element based on an MNOS structure by supplying to the gate a certain voltage with a specific sign. When negative voltage of a specific critical magnitude is supplied, at the interface of the silicon nitride and silicon oxide films a charge originates, whose magnitude depends both on the amplitude and length of the voltage pulse.

With this is established a state with a high threshold voltage, $U_{por\ v}$. When positive voltage of a specific critical magnitude is supplied, at the interface a charge originates which lowers the threshold value to a magnitude of $U_{por\ n}$. The difference $U_{por\ v} - U_{por\ n} = \Delta U_{por}$ is called the interthreshold zone (fig 3.50).

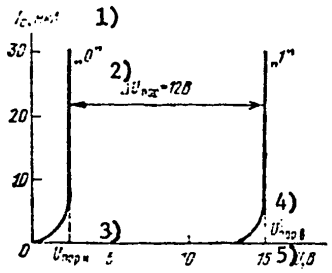

Figure 3.50. Characteristics of a Storage Element Employing an MNOS Structure

Key:
1. I_0, μA
2. $\Delta U_{por} = 12$ V
3. $U_{por\ n}$
4. U_{por}, V
5. $U_{por\ v}$

When a negative voltage ($U_z = -28$ V) is supplied to the gate of an MNOS transistor, a state is established which is characterized by a high threshold voltage of $U_{por\ v} = 15$ V, corresponding to the "1" level, and with $U_z = +28$ V, a state is established with a low threshold voltage of $U_{por\ n} = 3$ V, corresponding to the "0" level. The existence of an interthreshold zone of $\Delta U_{por} = 12$ V makes it possible confidently to distinguish two states of the storage element. For the purpose of reading out stored information ("1" or "0") to the gate of the MNOS transistor it is necessary to supply a readout voltage, U_{sch}, satisfying the condition $U_{por\ n} < U_{sch} < U_{por\ v}$.

Thus, if $U_{sch} = -(3$ to $5)$ V is supplied, then a storage element in which a "1" ($U_{por\ v} = 15$ V) was entered beforehand will change to the conduction state. And if a "0" was entered beforehand ($U_{por\ n} = 3$ V), the storage element will not conduct. The readout signal can be separated by means of a not too high load resistance connected between the output of the storage element and the ground (in a PZU [permanent memory] with two-coordinate access), or can be determined by the presence of current in the output circuit (in a PZU with word-by-word access).

Information entered in a storage element employing an MNOS structure is stored for a long time when the power is cut off, although at the beginning of the storage period the interthreshold zone is somewhat reduced. The storage properties of MNOS structures are improved in multiple repetition of the readout-readin cycle, which has occasioned a tendency to use them for the purpose of creating permanent memories (PZU's), and not memories with random access. Able to serve as an example of these PZU's are series K519 microcircuits, representing memory matrices for 128 and 256 bits with electrical rewriting of information (fig 3.51). Let us discuss the operation of these circuits in different modes.

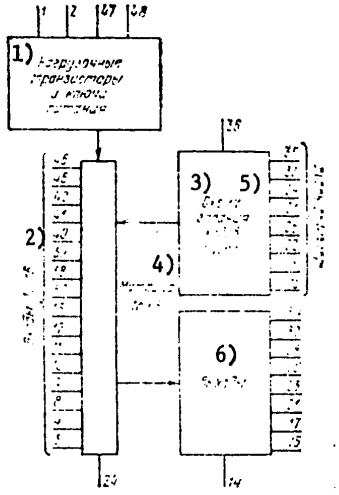

Figure 3.51. Functional Diagram of Type K519RYe1 Integrated Circuits

Key:

1. Load transistors and power switches
2. Inputs 1 to 16
3. Circuit for setting number codes
4. 16 X 8 matrix
5. Number code buses
6. Outputs

When a "0" is entered (erasure of information), to the "power readout" bus (lead 47) is supplied a -9 V voltage (the voltage in the remaining power buses (leads 1, 2 and 48) equals zero). To all the inputs (Vkh_1 to Vkh_{16}) is supplied a +48 V voltage, and to the "number code," "inhibit entry" (lead 36) and "select crystal" (lead 14), zero voltage. In the

"enter '1'" mode, to the "power readin" (contact 1), "reset readin" (contact 2) and "power readout" buses are supplied voltages of -48, -48 and -9 V, respectively; the voltages in the "reset readout" (contact 48) and "select crystal" buses equal zero. To the inputs (Vkh_1 to Vkh_{16}) is fed a -48 V voltage, and to the "number code" and "inhibit entry" buses, a -9 V voltage. During readout, to the "power readout" and "reset readout" buses are supplied respectively a voltage of -9 and -24 V (the voltage in the "power readin" and "reset readin" buses equals zero). To the inputs of the matrix (Vkh_1 to Vkh_{16}) is supplied a voltage of $U_{sch} \approx -7$ V , to the "number code" and "inhibit readin" buses, a zero voltage, and to the "select crystal" bus, a -9 V.

3.7.5. Storage Elements Based on "Silicon on Sapphire" Structures

One of the new trends in the creation of circuits for diode storage units is the employment of the technology conventionally called "silicon on sapphire" (KNS [SOS]). The utilization of thin single-crystal films of silicon grown on a sapphire substrate (a material having a crystal structure like that of silicon) makes it possible to produce devices with high radiation resistance, which is explained by the insensitivity of the dielectric substrate (sapphire) to radiation and the small areas of silicon p-n junctions. The area of the p-n junction in these devices is determined by the product of the thickness of the silicon film and the length of the junction line and equals $2 \cdot 10^{-5}$ to $8 \cdot 10^{-5}$ mm. This makes possible low junction capacitance and accordingly high speed of response (to 10^{-9} s).

The small area of the p-n junction makes it possible also to create devices by using the micropower integrated circuit variant. The data published testifies to the feasibility of creating permanent memories with the SOS technology with a high level of integration (of 5120 diodes on a single crystal) distinguished by an access time of 20 ns and dissipated power of 0.06 mW per diode. On the basis of these crystals it is possible to put together PZU's of different capacity, e.g., for 3200 single-bit words (one base crystal), 384 16-bit words (two base crystals) and 2048 20-bit words (nine base crystals). However, this trend for a number of reasons has not yet received sufficient development. The series K139 microcircuits based on SOS have a limited application.

3.7.6. Storage Elements Based on New Materials

Of great interest are developments of storage units based on new materials. An example of such a development is integrated circuits employing switches made of a vitreous semiconductor of the K524RP1 type (fig 3.52a), in the form of a storage matrix of a permanent reprogrammable memory (PPZU), with 256 bits (equivalent to this integrated circuit is a PPZU employing amorphous semiconductors of the C7010 type, made by the Nitron firm in the USA).

This circuit permits 100 rewrite cycles and makes it possible to store information for 10,000 h when the power is cut off. A structural diagram

for the rewriting of information is given in fig 3.52b. Information is read in successively into each storage element. Here the bit bus selected is grounded and to the selected number bus is supplied a plus readin pulse. When a "0" is read in, the $U_{vkh\ [input]}$ = 19 to 30 V , I_{vkh} = 3 to 7 mA , and $\tau_{i\ [pulse]}$ = 10 to 20 ms ; when a "1" is read in, U_{vkh} = 22 V , I_{vkh} = 70 to 100 mA , and τ_i = 3 to 10 μs . When a "1" is read in, readout can take place only 10 μs after termination of the readin pulse. The maximum permissible rewrite rate for a single storage element equals f_{max} = 5 Hz . The current for reading in a "0" is driven by oscillator G_0 through diode VD1 and clipping resistor R_0 (I_{vkh} = 11 mA). The current for reading in a "1" is driven by oscillator G_1 through diode VD2 (I_{vkh} = 100 mA). For the purpose of achieving consistent readin of a "0" and "1" a 16-fold repetition of the readin cycle is made possible.

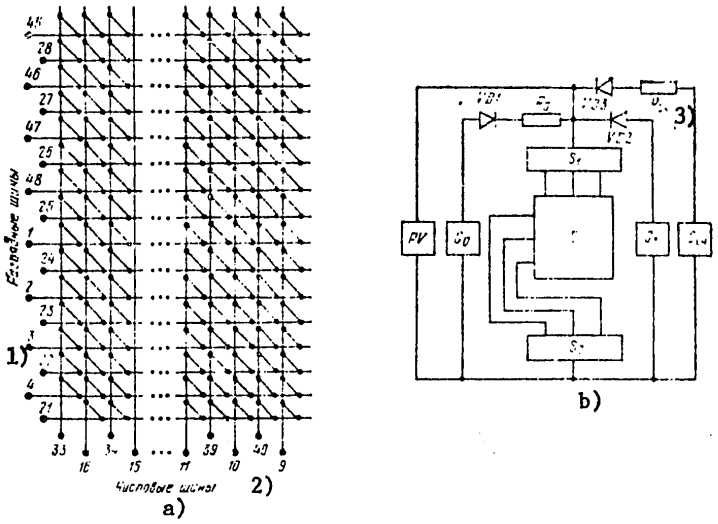

Figure 3.52. Schematic Diagram of Type K524RP1A Integrated Circuit (a) and Structural Diagram for Rewriting Information (b): D--type K524RP1A integrated circuit, S_1--switch for selection of number bus, S_2--switch for selection of bit bus, PV--voltmeter

Key:
1. Bit buses
2. Number buses
3. $R_{sch\ [readout]}$

When information is read out to the selected number bus, a plus pulse with $U_{sch} = 5$ V is supplied from oscillator G_{sch} through clipping resistor $R_{sch} = 6$ kΩ . Reading out can be performed by a pulse of any length greater than the length of $\tau_{sch} = R_{sch} \cdot 0.0035 \cdot C$ (where C is the capacitance of the matrix, equaling 100 pF). The pulse for reading in a "0" or "1," passing through the matrix's storage element (a diode made of a vitreous semiconductor), changes its resistance, which makes it possible in reading out information to produce at the output a voltage of a different magnitude, $U^0_{vykh\ [output]} = 2$ V , $U^1_{vykh} = 3.5$ V .

Able to serve as another example of a storage unit based on new materials is the type 307RV1 integrated circuit, representing the storage matrix of a PPZU with a capacity of eight bits, employing piezoelectric ceramics.

A schematic diagram of a type K307RV1 integrated circuit is shown in fig 3.53. A "1" is read in by supplying to leads 3 to 6 and 9 to 12 a -250 V pulse (τ_i > 20 ms). A "0" is read in by supplying a 250 V pulse (τ_i > > 20 ms). Leads 7(8) are hereby connected to ground. For the purpose of reading out recorded information it is necessary with leads 7(8) grounded to supply to leads 14(1) an excitation pulse of $U_{vozb\ [excitation]} \leq$ $\leq$ 100 V or $U_{vozb} \geq$ -50 V . The read-out signal can have a polarity opposite to the polarity of the excitation pulse. Its magnitude is also determined by the magnitude of the excitation pulse with $U_{vozb} = 10$ V , $U^{1(0)}_{vykh} = \pm$ 80 mV . Type K307RV integrated circuits make possible the storage of recorded information for 15 years with the supply voltage cut off. The maximum access rate is 100 kHz. At the present time work is being done to increase the capacity of the matrix to 256 bits.

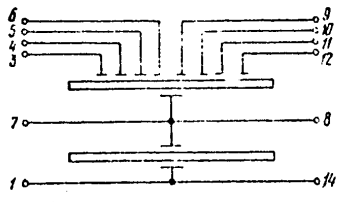

Figure 3.53. Schematic Diagram of K307RV1 Integrated Circuit

3.7.7. Major Series of Memory Unit Integrated Circuits and Their Functional Structure

As was demonstrated above, the key element of the matrix of a memory unit is a storage element, as which is used most often a flip-flop. But the

electrical parameters of a memory unit are not characterized only by the parameters of trigger circuits. The key characteristics of memory unit integrated circuits are the following: capacity, measured by the number of binary units of information (bits) which can be stored in the memory unit; speed of response, determined by the time for access to the memory unit* (speed of response can be characterized in addition by the readin time and readout time); and the power required by a single storage element (in mW per bit) or the power requirement of the entire integrated circuit of the memory unit as a whole. An important characteristic of memory unit integrated circuits is also the degree of integration, expressed as the number of elements or equivalent gates in the package.

The development of memory unit integrated circuits has been proceeding along two lines: Special series of memory units are being created, and memory units are being developed for the purpose of expanding previously developed digital series. For example, in recent years the TTL [transistor-transistor logic] and ESTL [electrical circuit - transistor logic] series of integrated circuits have been expanded, whose makeup includes OZU's [direct-access memory units] with a capacity of 64 bits and random access and control circuits (K155RU2 and K500RU148) and OZU's with a capacity of 256 bits and control circuits (K500RU410), and series of microcircuits employing CMOS [complementary MOS] transistors, whose makeup includes OZU integrated circuits with a capacity of 256 bits and control (564RU2 and K176RU2).

A list of special series of memory unit integrated circuits which have found application in computers for industrial purposes, used in different sectors of the national economy, and their characteristics are given in table 3.23. It should be emphasized that all memory unit integrated circuits developed in recent years contain, in addition to storage matrices, control circuits (decoders, output shapers, etc.), which has made it possible significantly to reduce the number of integrated circuits used for designing a memory unit, and at the same time to reduce its size, to simplify installation and accordingly to improve reliability. As is obvious from table 3.23, the majority of memory unit circuits have been developed on the basis of p-channel MOS technology, with which the unit cell of the memory unit is of small size.

The maximum capacity of OZU's and PZU's is 16 kbits. However in the immediate future must be expected the appearance of memory unit circuits with a capacity of 64 kbits. Of special interest are memory units executed according to the MNOS technology, since they make it possible to store information with the power cut off. For the 519RYe1 and 519RYe2 circuits shown in the table this time equals 2000 h. Great prospects in the area of improving the level of integration, reducing the required power and increasing speed of response are being opened up with further

*Here is meant the time from the instant the access signal is supplied to the instant of termination of the process of reading in or reading out information from the memory unit.

improvement of such circuitry and technological trends as CMOS, n-MOS and MNOS structures.

Table 3.23. List of Series of Memory Unit Integrated Circuits and Their Key Parameters

Условное обозначение микросхемы 1)	Функциональное назначение 2)	Технология 3)	Емкость (организация) бит 4)	Время выбора (считывания/записи), время выборки адреса, считывания информации мкс 5)	Удельная мощность потребления Вт/бит 6)	Условное обозначение корпуса 7)	Число элементов на кристалле 8)
К565РУ1	9) Матрица-накопитель ОЗУ со схемами управления	МОП *p*-канал 10)	256 (256×1)	11) $t_{в\,сч}=1{,}0$ 12) $t_{в\,зп}=1{,}0$	32) 33)	402.16-1	1861
К565РУ2	Матрица-накопитель ОЗУ со схемами управления	МОП *p*-канал	1024 (1024×1)	13) $t_{в\,з}=0{,}7$ 14) $t_{в\,сч}=0{,}5$		405.21-1	5325
К176РУ2	ОЗУ со схемами управления	КМОП 15) 16)	256 (256×1)	17) $t_{в\,сч}=0{,}5$		238.16-1	2298
К564РУ2А К564РУ2Б	ОЗУ со схемами управления	КМОП	256 (256×1)	18) $t_{в\,сч}=2{,}5$ $t_{в\,сч}=3{,}5$ (при $C_н=5$В)		402.16-11	1867
[illegible]	Матрица-накопитель ПЗУ с электрическим перепрограммированием 19)	МНОП 20)	128 (16×8)	$t_{в\,сч}=0{,}25$	0,17 (при обращении) 0,017 (при хранении)	201.16-1	454
[illegible]	Матрица-накопитель ПЗУ со схемой частичной дешифрации и электрической перезаписью информации 21)	МНОП	256 (64×4)	$t_{в\,сч}=0{,}3$	0,15	201.16-1	923
[illegible]	ПЗУ с полной дешифрацией адреса, входными защелками и схемой [illegible] 22)	МОП *p*-канал 23)	1496 (512×8)	$t_{в\,з}=1{,}5$	0,25	402.24-2	1550
К556РТ4 К556РТ4А К556РТ4Б К556РТ4В К556РТ4Г	ОЗУ со схемами управления (статического типа) 24)	МОП *n*-канал	4096 (4096×1)	$t_{в\,сч}=0{,}1$ $t_{в\,сч}=0{,}09$ $t_{в\,сч}=0{,}75$	0,175 (при обращении) 0,035 (при хранении)	201А.22-1	19136
К565РУ4 К565РУ4А	ОЗУ динамического типа 25)	МОП *p*-канал	1024 (1024×1)	$t_{в\,зп}=0{,}65$ $t_{в\,зп}=0{,}9$	0,25	209.24-1	5485
К565РУ4А К565РУ4Б	ОЗУ со схемами управления	МОП *n*-канал	1024 (1024×1)	$t_{в\,сч}=0{,}45$ $t_{в\,сч}=0{,}85$	0,55	201.16-11	7142
К565РУ5А К565РУ5Б К565РУ5В	ОЗУ со схемами управления (динамического типа)	МОП *n*-канал	16К (16384×1)	$t_{в\,з}=0{,}2$ $t_{в\,з}=0{,}28$	0,04 (при обращении) 0,005 (при хранении) 0,03 (при обращении) 0,005 (при хранении)	201А.16-2	41372
К527РУ5А К527РУ5Б	ОЗУ со схемами управления	МОП *p*-канал	1024 (1024×1)	$t_{в\,з}=0{,}09$ $t_{в\,з}=0{,}95$	0,3 (при обращении)	201А.16-2	7129
К500РУ1А К500РУ1Б К500РУ1В	ОЗУ	ИЛ 26)	4096×1 2×4×1	$t_{в\,з}=0{,}180$	0,13 0,25 0,25	405.21-2	19230
К573РТ1А К573РТ1Б	Матрица-накопитель постоянной перепрограммируемой ЗУ 27) 28)	стеклообразный полупроводник	128 256	$f=5$ Гц перезаписи 29)		214.48-1	256 512
К500РР1 К500РР1Б	Матрица-накопитель ПЗУ со схемами управления, с электрической перезаписью информации (число циклов перезаписи — 10^4) 30)	ИЛ	2048 1024	$t_{в\,з}=5$ мкс $t_{хр}=3{,}000$ ч 31)	0,15 0,3	405.21-2	7156 3994

[Key on following page]

Key:

1. Conventional designation of microcircuit
2. Functional purpose
3. Technology
4. Bit capacity (layout)
5. Cycle (readout/readin), readin, address access, and information readout time, μs
6. Specific power requirement, mW/bit
7. Conventional designation of package
8. Number of elements in crystal
9. OZU storage matrix with control circuits
10. p-channel MOS
11. Readout cycle time
12. Readin cycle time
13. Address access time
14. Readin time
15. OZU with control circuits
16. CMOS
17. Readout access time
18. With $U_{i.p}$ [supply voltage] = 5 V
19. PZU storage matrix with electrical reprogramming
20. MNOS
21. PZU storage matrix with partial decoding circuit and electrical rewriting of information
22. PZU with complete address decoding, output amplifiers and "integrated circuit selection" control circuit
23. p-channel MOS
24. OZU with control circuits (of the dynamic type)
25. Dynamic type OZU
26. I^2L [integrated injection logic]
27. Storage matrix of permanent reprogrammable memory unit
28. Vitreous semiconductor
29. Rewrite f = 5 Hz
30. PZU storage matrix with control circuits and electrical rewriting of information (number of rewrite cycles--10^4)
31. Storage time equals 2000 h
32. In access
33. In storage

3.8. Prospects for the Development of Digital Integrated Circuits

Each of the types of digital integrated circuits discussed above (bipolar TTL and ESTL and circuits employing MOS structures, such as p-channel, CMOS, MNOS and SOS) has its advantages and disadvantages, which govern their area of application. Bipolar integrated transistors are suitable for the commutation of relatively high currents, because of which integrated circuits employing these transistors are distinguished by high speed of response, whereby the stray capacitances of interconnections between packages have little influence on the operating speed.

By means of connecting many bipolar integrated circuits, each of which is of moderate complexity, it is possible to create high-speed equipment components. For the purpose of designing computers and components of discrete automatic devices TTL circuits are now used most extensively. Ultrafast equipment is being designed with integrated circuits of the ESTL type.

MOS transistors, because of their practicality, make it possible to achieve considerably greater packaging density of switching circuits in

the integrated structure than do bipolar isolated by a p-n junction or a film of SiO_2. Circuits utilizing MOS transistors arranged on a single crystal can equal whole functional units. This has determined their extensive application in electronic calculators, memory units and microprocessors.

In turn, the steadily increasing requirements from the viewpoint of improving speed of response, reducing the required power and reducing the dimensions and cost of equipment have entailed a quest for new methods making it possible both to improve the operating characteristics of MOS transistors and to increase the functional packaging density of elementary switching circuits made out of bipolar transistors. Let us discuss in greater detail new technological trends in the fabrication of digital integrated circuits.

3.8.1. Integrated Injection Logic

As a development of the very first switching circuit--a direct coupling transistor logic (TLNS) circuit--in recent years has appeared integrated injection logic (abbreviated IIL or I^2L). By means of circuits of the I^2L type it has been possible to overcome the traditional disadvantages of bipolar integrated circuits, i.e., their low packaging density and high dissipated power per gate. In terms of packaging density I^2L circuits even surpass MOS circuits (it is possible to package more than 200 gates on an area of 1 mm^2), and in terms of levels of dissipated power are comparable to CMOS circuits. The high speed of response characteristic of bipolar integrated circuits is furthermore maintained (the propagation delay time per gate reaches 5 ns). The best known variants of base inverter circuits utilizing injection logic of the I^2L type and I^2L type with Schottky diodes are shown in fig 3.54.

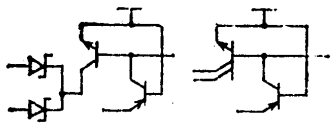

Figure 3.54. Base Inverter Circuits of the I^2L Type

The not too high dissipated power of I^2L circuits is explained by the absence of resistors. The injection of carriers into the area of the transistor's base is accomplished by means of active current generators designed from p-n-p transistors. The high speed of response with low required power is explained by the insignificant stray capacitances, the absence of charge accumulation and the very small difference in logical levels. Gates included in the circuit can be arranged along the injection buses, which

simplifies the topology. In addition, on a single crystal it is possible to unite without difficulty both digital I^2L and analog circuits.

As can be assumed, I^2L circuits with Schottky diodes will make it possible to achieve even higher speed of response (delay time of 0.1 ns) without increasing the power requirement.

3.8.2. MOS Circuits with n-Channels

The restrictions on speed of response characteristic of p-channel MOS circuits can be eliminated by means of n-channel MOS structures. The mobility of electrons in silicon is greater than the mobility of holes, which can make possible a two- to threefold greater switching speed in MOS circuits with an n-channel than in circuits with a p-channel. The latest achievements in technology have made it possible to eliminate the disadvantages of the first n-channel circuits. Utilization of the method of ion implantation and the application in load circuits of a structure with depleted and not enriched channels have made it possible to lower the supply voltage to 5 V, which makes these circuits compatible in terms of electrical levels with TTL's. The use of a separate bias voltage for the substrate has made it possible to increase the threshold voltage, which at the original stage was impermissibly low.

In table 3.24 are given comparative characteristics of the most well known classes of digital integrated circuits, which demonstrate that for the purpose of designing digital equipment integrated circuits of the I^2L, CMOS and n-MOS types would most convenient. Integrated circuits of the CMOS type have already become widespread. The striving for a fundamental improvement in the packaging density of bipolar integrated circuits, as well as for an increase in the speed of response of MOS circuits began after the invention of microprocessors.

Table 2. Key Characteristics of Classes of Digital Integrated Circuits

Characteristics	p-MOS	n-MOS	CMOS	TTL	ESTL	I^2L
Area required for a single gate (10^{-3} mm^2)	5 to 7	3.7 to 5	6.25 to 18.7	12.5 to 37.5	12.5 to 31	2.5 to 3.7
Delay originating in one gate, ns	>100	40 to 100	15 to 50	3 to 10	0.5 to 2	>5
Static dissipated power, mW	2 to 3	0.2 to 0.5	<0.001	1 to 3	5 to 15	<0.2
"Power X speed of response" indicator, pJ	200	10 to 50	3	10	10	<1

[Table continued on following page]

Number of diffusion and ion doping processes	2	3	4	4	4 to 5	3 to 4
Number of masking steps	5	6	7	7	8 to 9	5 to 7

At the present time microprocessor circuits based on I^2L are being developed. In particular, the type K586IK1 integrated circuit (an analog of the type SBP-0400 integrated circuit) represents a microprocessor on a single crystal with an operation execution cycle period of 1 μs and a total power requirement of 150 mW. Also being developed are single-crystal central processors (similar to the Intel type 8080 integrated circuits) utilizing n-channel technology.

A few words should be said about trends in the further development of MOS structures, in particular, DMOS (an MOS transistor fabricated by the method of double diffusion) and VMOS (an MOS transistor with a V-shaped groove). Both these structures make it possible to reduce the length of the channel in an MOS transistor. In DMOS structures this is achieved by carrying out two successive diffusions of impurities with opposite types of conduction. The drift region proves to be depleted and the switching time with such a short channel is considerably reduced.

In VMOS devices the thickness of the source-drain gap is determined by the thickness of the epitaxial or diffusion layer revealed in anisotropic etching. As the result of etching, in diffusion or epitaxially grown films are formed V-shaped grooves which reveal a thin layer with a new formed surface. The substrate becomes the source and the upper diffusion region the drain. The gate is created on the beveled side of the etched groove by means of oxidation and the deposition of a film. Examples of discrete VMOS transistors are devices of the KP901 to K904 type, which have high operating voltages (30 to 100 V), a gain slope of 30 to 100 mA/V, and a drain current of 0.1 to 1 A.

In both designs of these promising MOS structures control of the gain-source distance is accomplished by technological methods and does not depend on the capabilities of photolithography, as in all other methods of fabricating devices. As the result of utilizing the above-mentioned methods it is possible to create MOS devices with a switching delay on the order of 1 ns with voltages of 5 V. This speed of response is comparable to the fastest series of TTL circuits.

In addition to bipolar and MOS circuits, in recent years have appeared devices with charge coupling (PZS's), which combine in themselves two important functional properties--the ability to store information (represented by the charge of mobile carriers), and the ability to transmit it directionally.

The key merits of PZS's as compared with bipolar and MOS circuits are the following: a high degree of integration (up to 150,000 bits/cm^2), high speed of response (dozens of MHz in ordinary PZS's with surface charge transfer and dozens of GHz in PZS's with an ion doped recessed channel), a low power requirement (5 to 10 μW/bit) and basic design and technological simplicity.

However, PZS's require special circuits for linking with bipolar and MOS integrated circuits, which can be numbered among their disadvantages. PZS's come under the heading of devices of the dynamic type and for their operation are required oscillators which form trains of clock pulses. Already created and having found commercial application are shift registers and memory units with random access employing PZS's. For example, the K534IR1 type integrated circuit is in the form of a shift register with a capacity of 16,384 bits with an information transmission rate of 8 Mbits/s, a maximum clock pulse frequency of 2 MHz and a power requirement in the storage mode of 30 μW/bit.

It is to be expected that after the mastery in production of circuits utilizing PZS's they will find extensive application in equipment.

3.9. Microcalculators

As was indicated above, at the present time integrated circuits employing CMOS transistors have become widespread. The complementary technology makes it possible to produce circuits with a high level of integration (up to 10,000 elements on a crystal) and a low static power requirement (to single numbers of microwatts per switch). The increase in the functional complexity of CMOS integrated circuits has made it possible to create in a single crystal complete digital devices of the processor type, and this, in turn, has served as the basis for the development of small electronic keyboard computers (EKVM's)--so-called "pocket" EKVM's, or, in other words, microcalculators.

As an example let us discuss the design principle of a microcalculator of the "Elektronika B3-04" type (fig 3.55).

The input unit is designed for transmitting to the keyboard computer raw data and commands from the keyboard unit. Information in the form of a decimal code enters the decoder input, where it is converted into binary coded decimal code and the coding of commands is carried out.

The synchronization unit generates the necessary trains of pulses controlling the operation of all the keyboard computer's units. It consists of a master oscillator and a set of delay lines (with logical feedback).

The programmable unit generates the required sequence of microcommands depending on the operation key pressed on the input unit.

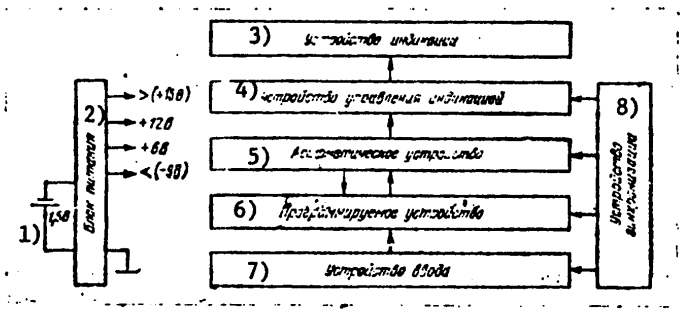

Figure 3.55. Structural Diagrams of "Elektronika B3-04" Type Electronic Keyboard Computer

Key:

1. 1.5 V
2. Power supply
3. Display
4. Display control unit
5. Arithmetic unit
6. Programmable unit
7. Input unit
8. Synchronization unit

The arithmetic unit (AU) makes possible performance of addition, subtraction, multiplication and division operations. It consists of a binary coded decimal sequential adder-subtractor operating in 8-4-2-1 code, dynamic information storage registers and circuits for controlling copying of information and addition.

The display control unit is designed for outputting raw data and the results of computations to the display. The display itself is designed in a keyboard computer of the B3-04 type on the basis of liquid crystals and serves the purpose both of visually monitoring raw data and of registering the results of computations.

The power supply transforms the voltage of the d.c. (1.5 V) chemical element into the following series of voltages: +6 V (for powering the logic section of the computer, which performs all arithmetic operations), +6, +12, +15 and -9 V (for powering the display). This computer has its own synchronizer. The frequency of the master oscillator is f_0 = 100 kHz , and the clock frequency equals $f_t = f_0/3$.

A list of the integrated circuits which are used in a keyboard computer of the B3-04 type and their electrical parameters are presented in table 3.25. The system for controlling the display is executed with integrated circuits of the K145AP1, K145AF1 and K145PP1 type. The K145IP1 circuit enables the performance of all arithmetic operations and conversion of the

data and operation code into binary coded decimal code, and also converts it into the segment code required for the display control system. The K145IP2 integrated circuit serves the purpose of storing operands and results of an operation.

Table 3.25. Integrated Circuits with Which a Keyboard Computer of the "Elektronika B3-04 Type is Designed, and Their Electrical Parameters

Conventional designation of integrated circuit	Functional purpose	Number of elements in crystal	Conventional designation of package	Electrical parameters		
				U_{vkh}, V	U_{vykh}, V	P_{pot}, mW
K145AP1A	Shaper of pulses for controlling segments	378	No GOST*	9.2	9.2	6.6 10.6
K145AF1	Digit selector	12	Ditto	-	18	7
K145PP1A K145PP1B	Display control circuit	642	"	4.6	9.2	6.6 10.6
K145IP1A K145IP1B	Processor	3400	"	4.4	4.6	3.3 5.3
K145IP2A K145IP2B	Storage register	1492	"	4.6	4.6	3.3 5.3
K145PN1	Voltage transformer	4	401.14-2	-	-	5

Note: For the K145PN1 integrated circuit U_{st} = 12 to 13.5 V with $I_i \leq$ $\leq$ 1.5 mA .

The structural diagram for control of the display is illustrated in fig 3.56. It is organized according to the matrix method with the display bits divided into even and odd, which has made it possible to unite like segments of adjacent display bits (1r and 2r, 3r and 4r, 5r and 6r, and 7r and 8r) and to reduce twofold the number of display leads. The "K"

*Not specified in an All-Union State Standard.

(constant) and "-" segments are connected to the common buses of the odd and even bits, respectively. The digit selector generates commmands for lighting the even and odd digits.

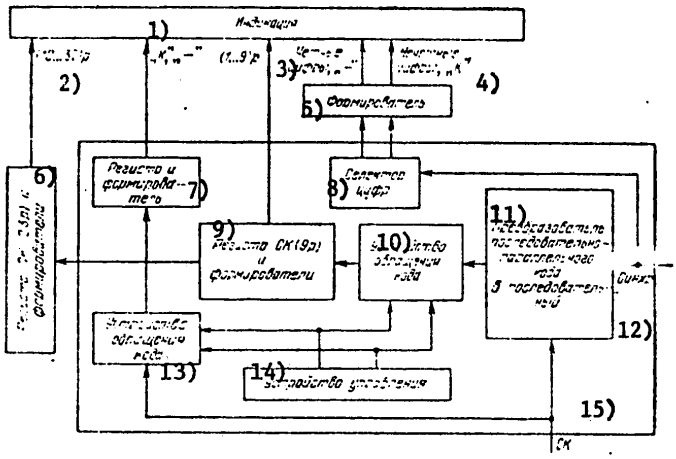

Figure 3.56. Control of Display

Key:

1. Display
2. (10 to 32)r
3. Even digits
4. Odd digits
5. Shaper
6. Segment code (23r) register and shapers
7. Register and Shaper
8. Digit selector
9. Segment code (9r) register and shapers
10. Code access unit
11. Converter of series-parallel code into series
12. Synchronization
13. Code access unit
14. Control unit
15. Segment code

A structural diagram of an integrated circuit of the K145UP1 type is shown in fig 3.57. Its operating half consists of a collection of the following units: an adder-subtractor, a data and command code storage register, a unit for correcting pseudosums and determining the position of the decimal point, a unit for recoding data represented in the decimal system into binary coded decimal code, a unit for coding information for outputting it to segmented displays, a unit for generating control pulses. The operating part performs the processing of information, such as addition, subtraction,

multiplication, division, computation with a constant and code conversion. Here information is circulated through a programmable logic matrix.

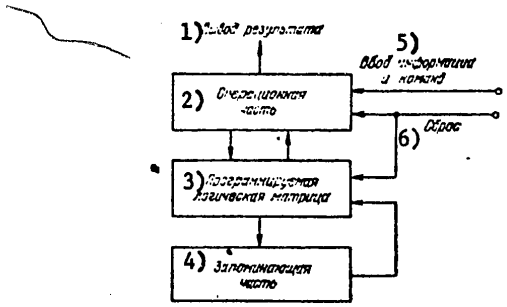

Figure 3.57. Structural Diagram of Processor Employing Integrated Circuits of the K145IP1 Type

Key:

1. Output of result
2. Operating section
3. Programmable logic matrix
4. Storage section
5. Entry of information and commands
6. Reset

The programmable matrix consists of a set of AND and OR gates and can be divided into the following three sections: a switching circuit for the circulation of information in the execution of decisions and coding, an analysis circuit (two dynamic trigger circuits), and a circuit for controlling the storage section.

The storage section is a set of eight dynamic trigger circuits making possible the storage of micro-operations. Micro-operations are formed in relation to the information entered into the keyboard computer, the state of analysis circuits, and the previous micro-operation.

The integrated circuits developed for keyboard computers of the "Elektronika B3-04" type are whole units, implementing, as was demonstrated above, not individual logic functions, but complex arithmetic and logic operations and making it possible to perform the four arithmetic operations and operations with a constant. Other keyboard computers have also been created, developed on the basis of series K145 CMOS integrated circuits (table 3.26).

3.10. Microprocessors

The increase in the degree of integration of integrated circuits and the improvement of their technical and economic characteristics have made it possible with high results to utilize computing equipment in many new areas--from units of industrial equipment and monitoring and test

equipment to cash registers and keyboard computers. The process of the spread of this computer technology has been accelerated considerably with the employment of microprocessors (MP's). In terms of architectural and structural solutions, MP's are similar to the processors of "big" computers the processing of information in which is performed according to a program (or microprogram).

Table 3.26. List and Structural Makeup of Keyboard Computers Developed on the Basis of Series K145 Integrated Circuits

Type of keyboard computer	Conventional designation of integrated circuit used	Functional purpose	No of elements in crystal	Conventional designation of package
B3-18	K145IP12	Processor, I/O control unit for single-crystal engineering calculator	16,000	244.18-1
B3-21	K145IK501 K145IK502 K145IK503	Operating unit whose control PZU is programmed to perform functions in keeping with its design	9,800	244.48-1
	K145IR1	Dynamic shift register for 1024/1008 bits	6,167	209.24-1
	K165GF2	Four-phase pulse clock	188	301.12-1
B3-30	K145IP14-K	Processor, I/O control unit for single-crystal microcalculator utilizing six basic arithmetic operations and a display with field effect liquid crystal indicators	6,000	

The very name "microprocessor" refers to the execution of the processor by employing one or more crystals of a semiconductor microcircuit. Microprocessors are playing the role of the major functional units of a new class of computers, so-called microcomputers, whose distinctive feature is that they are implemented with integrated circuits of improved degrees of integration (the third and fourth). These integrated circuits perform certain simple operations by means of a special-purpose control program (single-program operating mode).

Microcalculators became the preparatory stage in the development of MP's and microcomputers. It is precisely in them that the topological,

circuitry and architectural solutions were worked out which were later widely employed in the creation of the first MP's. Along with program MP's (controlled by microprograms) in recent years integrated circuits have appeared with increased functional complexity, performing different kinds of logical or mathematical processing of information. The algorithm for their operation is determined not by a program but by a functional circuit. These integrated circuits can be called special-purpose microprocessors. In modern microcomputers these special purpose MP's enable the performance of input/output operations concomitantly with the operation of the main MP. However, most widespread have become microprocessors for a broad purpose--controlled by programs or microprograms--which will be discussed below.

3.10.1. Characteristics of a Microprocessor

A microprocessor is a data processing unit consisting of operating and control sections, which can be supplemented with a permanent memory (PZU), which serves the purpose of programming. Thus, an MP is a general-purpose digital electronic unit whose function is assigned by programming.

The first MP's consisted of a single crystal, but experience in using them demonstrated that for the purpose of creating a self-contained system it is necessary to add to such an MP an entire series of digital integrated circuits. Most convenient to use proved to be families of MP's compatible with one another, making up a configuration. These MP configurations (sets) have created the conditions for designing future digital devices by employing new architectural principles, among which can be named the mainline method of organizing different levels of the digital structure, enabling add-on capabilities for computer equipment, a multiprocessor structure, microprogram control of processors, self-containment of peripherals and standardization of a system's units. Practically all modern MP's are developed in configurations. The employment of program facilities in place of the switching of units for the purpose of altering the behavior of a processor has been conducive to considerable improvement in the efficiency of a system.

A typical operating program for an MP consists of a sequence of commands and instruction words, stored in the permanent memory with which the MP is supplied, to the processor. Usually these are programmable PZU's (PPZU's), which make it possible easily to rewrite, which in turn makes it possible sufficiently simply by means of software to enable a microprocessor to be used under new conditions of application, without resorting to individual extensive changes in hardware. Supplying a standard MP with a PZU which can be programmed in different ways makes it possible quickly to develop new designs.

The operating section of an MP enables logical processing of information circulating in the MP itself. These are operations by means of which computations are performed (binary addition, right and left shifts,

complements, etc.). The control section of an MP decodes instruction words and forms signals required for the performance of a specific operation. Each instruction word represents a short program consisting of elementary operations whose sequence is called a microprogram. The sequence of instruction words in keeping with which the control section of the MP operates is called the program. The program is written in the PZU, in which are stored both microprograms and control programs for solving a specific problem. Almost all models of MP's have a fairly great number of supplementary internal registers which serve the purpose of reducing the time for the execution of operations and of forming addresses of greater length than the basic bit configuration of the processor.

In many MP's there is a register sink storage which is used for storing subprograms and tables of interrupts and data. The sink storage consists of a group of connected registers and a counter which serves the purpose of selecting the appropriate register. Registers are cleared in an order which is the reverse of that in which they are filled, which makes it possible to reduce the number of program exchanges between the registers and the main memory, the capacity of the memory required and the time for processing arrays. Information can be processed simultaneously or sequentially.

In supplying MP's with interrupt facilities the possibility appears of combining arithmetic operations and input/output operations, which increases the processor's operating speed. In addition, the operating speed can be increased by the employment of new circuitry design principles based on new technological structures. Whereas the first MP's were developed by employing p- and n-channel MOS transistors with not too high operating speed, in recent times have appeared microprocessors utilizing bipolar integrated structures (I^2L and ESL), which have made possible a considerable increase in operating speed.

Generally an MP, even with the existence of a PZU with an entered control program, is still not a computer, and for the purpose of converting it into a microcomputer it is necessary to furnish it with input/output circuits which control the peripheral equipment. But the capabilities inherent in an MP make it possible to use it in all equipment in which by means of digital equipment it is possible to enable the performance of broad tasks relating to the processing of information according to a preset program. The number of different operations which can be performed by a microprocessor in some models reaches 100, whereby operations are provided for with a double word length and byte-by-byte processing of information.

In recent times, in addition to MP's with a fixed list of instruction words, have appeared MP's with microprogram control, making it possible to change the list of instruction words and control algorithms. With this the flexibility of the processor is increased and the implementation of relatively complex microcommands, e.g., such as a Fourier transform, is simplified. However, for the effective utilization of microprogram control it is necessary that the operating speed of the microcommand storage

be five to 10 times greater than the operating speed of the instruction word storage, since each instruction word is made up of a number of sequentially executed microcommands. The appearance of large-capacity fast PZU's will further the extensive introduction of microprogram control in the structure of MP's.

One important characteristic of MP's influencing their area of application is the word length. MP's in wide use at the current time are divided into three groups: 4-, 8- and 16-bit. The first are used chiefly in microcalculators and automatic cash registers and accounting machines, and the second in data processing systems, and the third in broad-application microcomputers.

As already mentioned above, one of the most important parameters of an MP is its operating speed. The mastery by industry of various circuitry trends has made it possible already today to reach an operating speed of from dozens of thousands to one million to three million brief "register-to-register" operations per second. In particular, for MP's implemented on the basis of p-MOS circuits--80,000 operations/s, n-MOS circuits--400,000 operations/s, CMOS circuits--400,000 operations/s, I^2L circuits--500,000 to 600,000 operations/s, TTLSh [transistor-transistor logic with Schottky diodes] circuits--1.2 million operations/s, and ESTL circuits--3.0 million operations/s.

On the basis of the distinctive features of the design of computers using enhanced-integration integrated circuits (fourth generation computers) and of the thesis of the universality of the employment of MP's for the optimal implementation on their basis of a broad range of computer hardware, it is possible to formulate specifications for microprocessor configurations:

The implementation of an extensive set of information processing algorithms. For this must be accomplished microprogram control, the capability of arbitrarily increasing the bit configuration, the number of general purpose registers, and the microcommand format, and of specialization of a configuration with regard to its basic purpose, and ensurance of functional completeness of a configuration.

Standardization and unification of the architecture, which will make it possible to orient a configuration toward a unified advanced structural design principle for computer hardware. For fourth generation computers this principle can be the reduction of the entire diversity of computer hardware structures to the structure of a processor executed on the basis of functionally complete modules united via mainlines and controlled by means of microprograms. The most constructive concept in the architecture of MP's at the present time is the digital module arrangement accompanied by appropriate alteration of the number of microcommands.

3.10.2. Medium Operating Speed Microprocessor Configuration

A typical microprocessor configuration (MK) enabling the design of digital computer hardware with broad functional capabilities and unified software (fig 3.58) includes hardware and microprogram software. The microprogram software implements a system of instruction words in the form of microprograms, each of which consists of a sequence of microcommands. For the purpose of simplifying the development and debugging of microprograms, they are divided into addressing and operating. This makes it possible to provide the capability of expanding the system of instruction words, economizes on the capacity of the memory, and increases the efficiency of computing facilities.

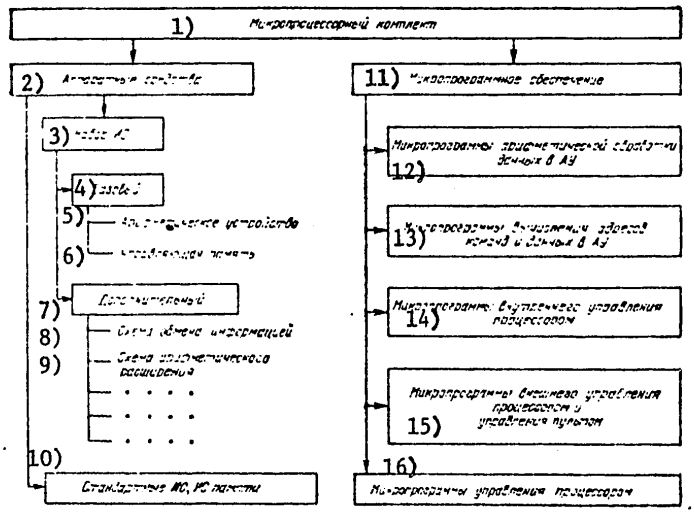

Figure 3.58. Typical Structure of Microprocessor Configuration

Key:

1. Microprocessor configuration
2. Hardware
3. Set of integrated circuits
4. Basic
5. Arithmetic unit (AU)
6. Control storage
7. Supplementary
8. Information exchange circuit
9. Arithmetic expansion circuit
10. Standard integrated circuits, storage integrated circuits
11. Microprogram software
12. Microprograms for arithmetic processing of data in the AU
13. Microprograms for computing addresses of instructions and data in AU

[Key continued on following page]

14. Microprograms for internal control of processor
15. Microprograms for external control of processor and controlling console
16. Microprograms for control of processor

The hardware of a typical microprocessor configuration can be divided into basic and supplementary. The minimal (basic) set of integrated circuits makes it possible to construct various digital computer hardware (TsVS). Included in this set are the circuitry of the arithmetic unit and the control storage. The expanded supplementary set of integrated circuits makes it possible to construct digital computer hardware in the most efficient way and contains a circuit for the exchange of information, a circuit for arithmetic expansion, a circuit of bilateral amplifiers, etc. The structure of the supplementary configuration can vary depending on the distinctive features of the digital integrated circuits designed. As an example let us discuss a microprocessor configuration based on series K587 and K530 integrated circuits (table 3.72).

Table 3.27. Functional Structure of Microprocessor Configuration Based on Series K587 and K530 Integrated Circuits

Conventional designation and description of microcircuit	Technical characteristics	Purpose
	Basic Configuration	
K587IK2 (arithmetic unit)	Four-bit, self-contained microprogram controlled asynchronous digital data processing module	Receipt, direct-access storage, processing and readout of digital and instruction information Designing operating units of digital computer hardware with different bit configurations which are multiples of four
K587RP1 (microprogram control unit)	Self-contained asynchronous former of sequences of 14-bit parallel codes with an information capacity of 64 logical products	Designing microprogram control units with different information capacities, Microcommand generator. Designing very simple digital control circuits (in self-contained mode)
K587IK1 (data exchange unit)	Eight-bit, self-contained microprogram controlled asynchronous	Organization of intra- and extra-processor parallel and sequential exchange of data of different bit

[Continued on following page]

	module for processing and commutating digital information	configurations (multiples of eight), organization of interconnection (interfacing) of processors and channels, designing interrupt units. Used in controllers of peripheral units and for controlling OZU's
K587IK3 (arithmetic expander)	Eight-bit self-contained microprogram controlled asynchronous hardware multiplication module	Performance of hardware multiplication of two operands, shifts, and retrieval of bit codes (operands are whole numbers without a sign or whole numbers in complement form with a sign in the high-order bit); matrix expansion of a bit configuration which is a multiple of eight is possible
	Supplementary Configuration	
K530AP2 (integrated circuits of bilateral amplifier-shapers)	Self-contained asynchronous four-bit bilateral transceiver of digital information	Synchronous and asynchronous transmission of binary information through two-way communications lines; matching of logic levels of TTL and CMOS integrated circuits. Communications line add-on

Note: K587IK1, K587IK2, K587IK3 and K587RP1 microcircuits are made with CMOS structures in a cermet 429.42-1 package, and the K530AP2 microcircuit is based on TTL with Schottky diodes in a 402.16-16 package.

The arithmetic unit (a K587IK2 type integrated circuit) contains 2500 CMOS transistors and includes the following functional units: a parallel arithmetic-logic unit, a block of general-purpose registers, a shifter unit, a state register, an operating register, a microcommand register, three four-bit channels, exchange circuits, an instruction word decoder and a synchronization unit. The arithmetic unit makes it possible to increase the bit configuration to 32 bits, has 168 types of microcommands and makes possible a microcommand execution cycle of 2 μs with a required static power of 10 mW.

The microprogram control unit (a K587RP1 type integrated circuit) contains 6000 CMOS transistors and includes the following functional units: a permanent memory of the "programmable logical matrix" type, a programmable layer of inverters, 13- and 3-bit input registers, a 5-bit sequencing address register, an output microcommand register, a data exchange circuit and a synchronization unit. The microprogram control unit has the following characteristics: number of logical products 64, bit configuration for

input 18 bits, bit configuration for output 14 bits, microcommand access cycle 1.5 μs with required static power of 10 mW. The data exchange unit (a type 587IK1 integrated circuit) contains 3500 CMOS transistors and includes the following functional units: three 8-bit channels, exchange circuits, a trap circuit, 8-bit registers, a logic unit, a commutator, a mode register, a state mask register, a state formation circuit, a microcommand register, a microcommand decoder, a synchronization unit, an original setting circuit, and an expansion flip-flop. The data exchange unit makes it possible to increase the bit configuration to 32 bits, enables the commutation of three mainlines and has 60 types of microcommands. The microcommand execution cycle is 1.5 μs with a required static power of 10 mW.

The arithmetic expander (a 587IK3 type integrated circuit) is constructed with 4500 CMOS transistors and unites the following functional units: two 8-bit channels, a 5-bit channel, an exchange circuit, a 7-bit microcommand register, two 8-bit operand storage registers, two 8-bit operation result storage registers, a 2-bit name code register, a 3-bit position code register, a setting flip-flop, a microcommand decoder, a multiplication unit, a summation unit, a bit code retrieval unit, a state formation unit, a synchronization unit, and an original setting circuit. The arithmetic expander makes it possible to increase the bit configuration to 64 bits, has 64 types of microcommands, has a microcommand execution cycle of 2 μs with a required power of 10 mW.

On the basis of the microprocessor configuration of integrated circuits discussed above can be constructed different computer units of the required bit configuration, microcomputers, and special-purpose computing devices.

In fig 3.59 is shown the structural diagram of a microprocessor implemented with three integrated circuits of the configuration presented above and a conventional illustration of one of the microprocessor's units, the AU. The purpose of the AU's leads is shown in table 3.28. The structural layout of a 16-bit increased-operating-speed microprocessor system (fig 3.60) includes the following: eight type K532IK4 integrated circuits, two type K588RP1 integrated circuits (with unified "stitching"), and 11 series K564 integrated circuits of types TM3, KT3, LYe5, LA7, LA8, TR2 and ID1. The distinctive features of the structure of this microprocessor system are parallel execution of a command in two AU's--an operating (OAU) and indexing (IAU)--whereby the OAU performs operations on operands and the IAU simultaneously prepares the address for operands and instruction words; combining of retrieval from the memory of the next instruction word with fulfillment of the current instruction word; separate address and data buses; and unified addressing of memory cells and registers of external units.

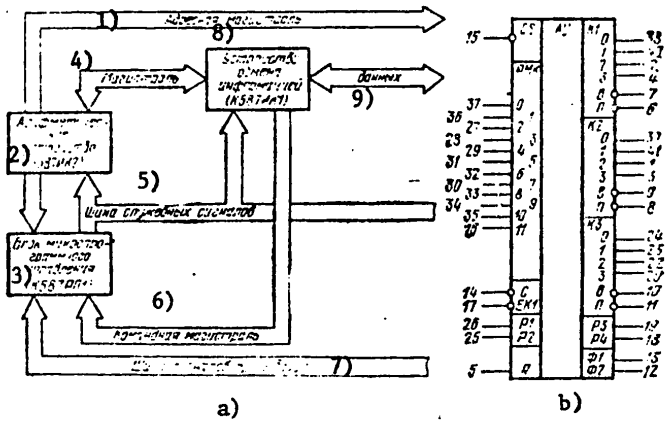

Figure 3.59. Structural Diagram of Microprocessor (a) and Conventional Graphic Representation of Arithmetic Unit (b)

Key:

1. Address mainline
2. Arithmetic unit
3. Microprogram control unit
4. Mainline
5. Working signal bus
6. Instruction word mainline
7. Interrupt signal bus
8. Data exchange unit
9. Data

Table 3.28. Purpose of Leads

Contact	Designation	Description
15	CS	Inputs for permitting reception and performing microcommands
14	C	
37,36,27,28, 29,31,32,30, 33,34,35,16	PMK_0 to PMK_{11}	Inputs of bits of microcommand register
17	EK_1	Input for permitting operation for first information channel
26	P_1	Input of state code of carry circuit to low-order bit
5	R	Input for setting unit to original state
38.40,2,4	$K1_0$ to $K1_3$	Inputs/outputs of bits of information channel K1
6	$K1_p$	Input/output of signals for termination of reception and outputting information through channel K1

[Continued on following page]

7	$K1_v$	
39,41,1,3	$K2_0$ to $K2_3$	Inputs/outputs of bits of information channel K2
8	$K2$	Input/output of signals for termination
9	$K2^p_v$	of reception and outputting information through channel K2
24,23,22,20	$K3_0$ to $K3_3$	Inputs/outputs of information channel K3
21		Common
11	$K3$	Input/output of signals for termination
10	$K3^p_v$	of reception and outputting information through channel K3
19	P_3	Output of state code of carry circuit from high-order bit
		Input/output of state code of carry circuit of:
25	P_2	Low-order bit
18	P_4	High-order bit
13	F_1^4	Input/output of signal regarding termination of execution of operation
12	F_2	Synchronization input/output
42	$U_{i\ p}^2$	Power supply

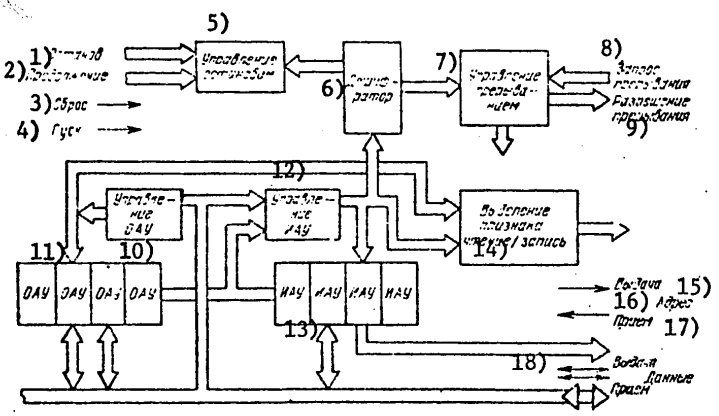

Figure 3.60. Structural Diagram of 16-Bit Microprocessor System Based on a Microprocessor Configuration (MK) Consisting of Series K532, K588 and K564 Integrated Circuits

[Key on following page]

Key:

1. Stop
2. Continue
3. Reset
4. Start
5. Control stop
6. Decoder
7. Control interrupt
8. Interrupt interrogation
9. Interrupt permission
10. Control OAU
11. OAU
12. Control IAU
13. IAU
14. Separation of read/write operation
15. Output
16. Address
17. Reception
18. Data

The key characteristics of the system are as follows: Bit configuration of instruction words, data and addresses--16 bits; number of program accessible registers of processor in OAU--eight operating registers, one working register and one result indicator register, in IAU--eight indexing registers, including an address counter and sink address indicator; number of instruction words distinguished by operation code or type of addressing--about 200; addressing takes place through indexing registers (IR's). Types of data addressing: direct (operand in second word of instruction); according to indexing register, IR; according to indexing register with a consecutive increment; with a preliminary decrement; with modification by the second word of the instruction and with modification by other IR's. In the system there is a single-level vector interrupt and interrupt lock-out. Operating speed for key instructions of the "add register to register" type is 250,000 operations/s, and for instructions of the "add register to memory cell" type, 100,000 operations/s.

The existence of microprograms makes it possible to realize added capabilities (by employing additional circuits), such as a pulsed interrupt with a fixed input address, direct access from an external unit to the memory and access to the memory from the console by employing the processor. A summary of OAU and IAU instructions is given in table 3.29.

The MK's discussed above, based on series K587 integrated circuits, make possible an operating speed of computing operations of the register-register type of 250,000 operations/s with a static power requirement of 10 mW per microcircuit.

3.10.3. Improved Operating Speed Microprocessor Configuration

When it is necessary to improve the operating speed of digital computing systems it is possible to recommend a microprocessor configuration utilizing series K589 and K556 integrated circuits, designed on the basis of transistor-transistor logic with Schottky diodes (TTLSh) (table 3.30). The key electrical parameters of microcircuits of this MK are given in table 3.31. Constructionwise series K589 and K556 integrated circuit MK's have plastic cases (table 3.32).

Table 3.29. List of OAU and IAU Instructions and Their Conventional Designations

1) Команды ОАУ			
2) пересылки, установки	3) смешанные	4) унарные	5) бинарные
(A/P_a)→A, $P_б$	*2 (A*1→$P_б$)	A(A/P_a)+1→A/A,P_a)	(A/P_a)*1$P_б$→A,$P_б$
(M МБ)→A (A/P_a)→A,(M/МБ)	A+P_a+P-»A AP_a—Зм→A	(M/МБ)+1→A A+1→A, (M/МБ)	A*1$P_б$→A (M/МБ)*1$P_б$→A
РП(- - | - -)A	A+P_a→A	P_a+1→A,P_a,(M/МБ)	A*1$P_б$→(A/A, $P_б$), (M/МБ)
E→A, РП (0, —1) -»A (0, 1) -»T		*2(A/P_a)→A	

6) Команды ИАУ		
переесылки, установки	7) условные переходы	8) системные
K→$P_в$	9) Условный переход по {T}=(0,1)	10) Разрешение/запрещение прерывания
$P_в$+K→$P_в$ $P_в$(-» | -) 13) стек // $P_в$(-|-)1→ →$P_в$	Конец цикла 12)	Останов 11)

Conventional designations and abbreviations: → --allocation operator; | --exclusive OR; A --OAU storage cell (working register); R_a and R_b -- operating register No a and b (a, b = 0 to 7); R_v --indexing register No v (v = 10 to 17); RP --result indicator register, consists of four flip-flops: R , Z , P and M ; Zm --borrow, Zm = 1 - R ; M --mainline; |←) MB --exchange of M with rearrangement of bytes; Ye --4-bit constant from instruction word field; K --second word of instruction; sink--region of memory addressed through address indicator has been drained; *1--general designation of the operations + (addition), - (subtraction), ∧ (logical multiplication), ∨ (logical addition) and + [as published]
[Continuation and key on following page]

(non-equivalence); *2--general designation of the operations inversion, LL/LP (logical shift left/right by one bit) and TsL/TsP (cyclic shift left/right one bit).

Key:

1. OAU instruction words
2. Copying, setting
3. Mixed
4. Unary
5. Binary
6. IAU instruction words
7. Conditional transfers
8. System
9. Conditional transfer with regard to
10. Interrupt permission/inhibition
11. Stop
12. End of cycle
13. Sink

Table 3.30. Structure of Improved Operating Speed MK Utilizing Series K589 and K556 Integrated Circuits

Description	Type	Analog
Microprogram control unit	K589IK01	3001 Intel
Central processor element	K589IK02	3002 Intel
Accelerated carry circuit	K589IK03	3003 Intel
Multimode buffer register	K589IR12	3212 Intel
Priority interrupt unit	K589IK14	3214 Intel
Bus shaper	K589AP16	3216 Intel
Bus shaper with inversion	K589AP26	3226 Intel
Programmable permanent memory	K556RYe4	-

Table 3.31. Key Electrical Parameters of MK Microcircuits Employing Series 589 Integrated Circuits

Parameter	K589IK01	K589IK02	K589IK03	K589IR12	K589IK14	K589AP16	K589AP2
Maximum static power requirement, $P_{not\ max}$, mW, not greater than	900	950	650	650	650	650	650
"0" output signal, U^{0}_{vykh}, V, not >	0.5	0.5	0.5	0.5	0.5	0.5 (outputs C_1 to C_4) 0.7 (outputs B_1 to B_4)	0.5 0.7

[Continued on following page]

"1" output signal, U^1_{vykh}, V, not <	2.4	2.4	2.4	3.65	2.4	3.65 (outputs C_1 to C_4) 2.4 (outputs B_1 to B_4)	3.65 2.4
Length of cycle, t_{ts}, ns	≥85	≥100	-	-	≥80	-	-
Pulse length, τ_i, ns	≥30	≥33	-	≥25	≥20	-	-
Time of delay in propagation of signal from input X_i to output Y_i, $t_{zd\ r.sr}$, ns	16 to 30	14 to 48	-	20	15 to 100	≤25 to 30	≤25
Group carry time, $t_{p\ g}$, ns (typical)	-	-	10	-	-	-	-
Ripple-through carry, $t_{p\ s}$, ns (typical)	-	-	13	-	-	-	-

[Continued on following page]

Notes: 1. Values of static parameters are indicated in the temperature range of T = -10 to +70°C and with a power supply voltage of 5 V ± 5 percent. 2. Values of dynamic parameters are indicated at T = 25°C and at the nominal voltage of the power supply.

Table 3.32. Types of Series K589 Cases

Type of integrated circuit	Conventional designation of case
K589IK01	230.40-1
K589IK02	247.28-1
K589IK03	247.28-1
K589IR12	239.24-2
K589IK14	239.24-2
K589AP16	238.16-2
K589AP26	238.16-2
K556RYe4	238.16-2

The MK discussed is intended for designing high-speed controllers (control units) with different types of organization, having a control pulse output rate of up to 10 MHz. With it it is possible to construct micro- and minicomputers for different purposes with a number of operations of the register-register type of up to one million operations/s. Let us briefly consider each of the integrated circuits included in the structure of this MK.

[8144/475-8831]

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8831

UDC 681.142.2

DEVELOPING MULTILANGUAGE PROCESSORS

Moscow PROGRAMMIROVANIYE in Russian No 6, 1979, pp 44

[Article by V. T. Bombu: The Instrumental Complex T-SEMOL as a Means for Constructing Mobile Multilanguage Processors manuscript received 13 Jul 78

[Excerpt] This paper considers an instrumental complex as the basis for the automation of multilanguage translation systems. The general structure of the functioning of the complex is given; the means for lowering the expenditure of labor in interfacing the systems developed with various types of computer are described.

This paper considers the principles on which are based the instrumental programming complex (IK)T-SEMOL(1), which makes possible effective realization of multilanguage translation systems (TS) and their interfacing with computers of various types. The selection of effective syntactic and semantic formalisms, a single one of each for all the source languages of a multilanguage (TS) is a decisive point in the development of such systems. For the systems being developed today with the help of the IK's of four language TS's, for interactive mode, i.e., YeS (Unified System) computer, and batch mode, i.e. for the "El'brus" computer complex source programs use formalisms of the context sensitive grammar (KU-grammar) type and an expanded version of the SEMOL system programming language.

The use of KU grammars to describe the syntax of the language of programming and control through syntactic analysis of contexts also simplifies the realization of the semantic components of these languages, which are represented in the form of a set of a small number of interrelated modules of information. The SEMOL language which was designed for the description of programming and data segments of a TS, permits the developers to concentrate their efforts on the planning of programs and to express algorithms in a well-organized way.

The YeS-1030 serves as the instrumental computer in the use of the IK. To provide multiple compatibility of the TS's developed, the translator translates the SEMOL program into a specially developed abstract machine (AM) language, a program in which is represented as a set of macrocommands which permit symbolic designations of operands and macrooperations. The notation of the AM language was selected taking account of generally used mathematical notation and notation of existing programming languages.

A significant decrease in the cost of interfacing the system programs (with a new machine) can be achieved only after the boundary dividing its machine-independent phase from its machine-dependent one has been defined; although evidently there still do not exist any formal criteria for machine independence. The AM language is free of components related to the particular features of the system of command, the operational conditions and the input-output system of a given machine. The translator takes account of these specific conditions during the translation of the program module in the AM language (AM program) into the machine code (auto code) of the target machine. Two such translators for the ES computer and for the "El'brus" computer complex have been realized on the instrumental machine.

[160-9285]

9285
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USSR UDC 658.012.011.56

METHODS OF AND EXPERIENCE IN THE DESIGN OF DATA PROCESSING SYSTEMS

Kiev METODY I OPYT POSTRYENIYA SUSTEM OBRABOTKI DANNYKH [Methods of and Experience in the Design of Data Processing Systems] in Russian Izd-vo Institute Kibernetiki 1979 94 pp

TEMPERANSKIY, V. A. (editor)

[From REFERATIVNYY ZHURNAL: TEKHNICHESKAYA KIBERNETIKA No 11, Nov 79 Abstract No 11.81.677 K]

[Text] Problems in the design of data bases for various automatic information systems are considered, a hierarchical approach being taken to the design of interface languages for systems of data bases control and a general description being given of the interrogation language for the DALAN data retrieval system realized on the basis of the OKA data bases control system. An algorithm is proposed for semiautomatic design of thersauri in a dialog with the user and others. Results are presented pertaining to organization of a data base for systems of miner rescue operations and to the use of a system of teaching courses. This collection of articles is intended for specialists in software and information facilities for automatic control and data processing systems.
[178-2415]

2415
CSO: 1863

USSR UDC 681.51:51

DEBUGGING INSTRUCTIONS IN THE INPUT LANGUAGE OF THE 'POLE-2' PROGRAMS GENERATOR

Kiev (?) INSTITUT PROBLEM MASHINOSTROYENIYA AKADEMII NAUK UKRAINSKOY SSR in Russian preprint No 117, 1979 29 pp

MAN'KO, G. P.

[From REFERATIVNYY ZHURNAL: TEKHNICHESKAYA KIBERNETIKA No 11, Nov 79 Abstract No 11.81.816]

[Text] The main aspects of formulating boundary-value problems in mathematical physics for a solution with the aid of the POLE-2 programs generator are discussed here. The article is intended for a broad range of specialists working on the solution of two-dimensional boundary-value problems in mathematical physics. Figures 6; tables 6; references 9.
[178-2415]

2415
CSO: 1863

USSR UDC 681.51:681.3

DYNAMIC CHANGE OF PROGRAM PARAMETERS ON A UNIFIED SYSTEM YeS-1010 COMPUTER

Serpukhov INSTITUT FIZIKI VYSOKIKH ENERGIY in Russian preprint No 51, 1979 16 pp

SUKHORUKOV, A. N.

[From REFERATIVNYY ZHURNAL: TEKHNICHESKAYA KIBERNETIKA No 11, Nov 79 Abstract No 11.81.881]

[Text] DYNPAR is a sunprogram which allows the operator to change the internal parameters of a call-out program while it is being executed. It can be used as a means of communication between a call-out program and the operator (at the latter's initiative). Its implementation is based on an independent task written into the DYNPAR the performance of which proceeds at its own level of interruptions and with utilizing the apparatus of a monitor

for maintenance of subsystems. Described is also the interaction of DYNPAR with the call-out program, with the operator and with the monitor. The problem of writing independent tasks into one program is analyzed and some of the DYNPAR algorithms are shown.
[178-2415]

2415
CSO: 1863

USSR UDC 681.322.06

PROBLEMS IN SELECTING THE PROGRAM STRUCTURE FOR A DATA RETRIEVAL SYSTEM INCLUDED IN A MULTIPLE-ACCESS SYSTEM WITH MODULAR COMPUTER TECHNOLOGY

Moscow TRUDY INSTITUTA ELEKTRONNYKH UPRAVLYAYUSHCHIKH MASHIN [Transactions of the Institute of Electronic Control Machines] in Russian No 71, 1978 pp 115-121

KAROL', V. L.

[From REFERATIVNYY ZHURNAL: AVTOMATIKA TELEMEKHANIKA I VYCHISLITEL'NAYA TEKHNIKA No 11, Nov 79 Abstract No 11B111 by B. I. Ziskand]

[Text] A multiple-access system includes two subsystems: a data retrieval system designed for users' operation with the archives and a control system for users' problems entered at the terminals. Data retrieval from the archives proceeds in the dialog mode with the use of a step-by-step language. The user receives on each step of the dialog a list of alternatives for further search. As the program structure of a multiple-access system is meant the representation of this system in the form of several parallel computation processes executed in the course of answering inquiries, with an indicated interrelation between these processes. In this report an attempt is made to develop methods of analyzing and synthesizing program structures for data retrieval systems in multiple-access systems. Various structures of data retrieval systems and their mathematical models are considered. In data retrieval systems with a series structure, for instance, inquiries are processed strictly in a sequence and the programs implemented here form a single computation process. In data retrieval systems with a parallel program structure, on the other hand, each terminal has its set of servicing programs. These sets of programs form a parallel computation process. The main memory in such data retrieval systems increases proportionally with the number of terminals. In data retrieval systems with a limited-parallel

structure the number of parallel computation processes is smaller than the number of terminals. Here an inquiry is processed completely in each computation process. In data retrieval systems with a series-parallel structure an inquiry is processed in stages. An appropriate mathematical model has been selected for each kind of structure. The response time of a data retrieval system is evaluated as a function of the load. Data retrieval systems with a series-parallel structure have the best time characteristics under medium and heavy loads. The capability and the linguistic means of a data retrieval system depend on the size of the processing programs. A graph is shown which depicts the dependence of the memory capacity on the size of the processing programs for the various structures of data retrieval systems. With the load on a data retrieval system and the memory capacity given, one can select the structure for the system which will satisfy the quality criterion. Figures 3; references 7.
[179-2415]

2415
CSO: 1863

USSR UDC 681.322.06:512.64

LIBRARY OF APPLICATION PROGRAMS FOR THE SOLUTION OF SCIENTIFIC-TECHNICAL PROBLEMS WITH A DISK OPERATING SYSTEM IN A MODULAR SYSTEM OF COMPUTER TECHNOLOGY (SECOND VERSION) (Materials on Software)

Leningrad FIZIKO-TEKHNICHESKIY INSTITUT AKADEMII NAUK SSSR in Russian preprint No 608, 1979 21 pp

GRIGOR'YEV, V. N., GUMAN, V. N., LEVSHAKOV, S. A. and POPOVA, N. K.

[From REFERATIVNYY ZHURNAL: AVTOMATIKA TELEMEKHANIKA I VYCHISLITEL'NAYA TEKHNIKA No 11, Nov 79 Abstract No 11B79]

[Text] Libraries are described which contain subprograms implementing the basic methods in computer mathematics and mathematical physics as well as service programs (second version). The classes in the latter version are: input-output, operations on matrices, integration of ordinary differential equations and systems, evaluation of integrals, solution of linear and nonlinear equations, approximation, Fourier analysis, method of least squares, statistics, linear programming, simulation of stochastic processes, auxiliary programs, special functions, and polynomials. The programs are written in two languages, FORTRAN-4 and ASSEMBLER. Instructions to the programs

are written in separate texts, in a format suitable for viewing on a display. The library is recorded on magnetic tapes and can be used with third-generation computers such as M-4030, Unified System YeS-1030 and others. References 2.
[179-2415]

2415
CSO: 1863

USSR UDC 681.322.06:519.68

ONE ALGORITHM IN THE SOFTWARE FOR AN M-220A--BESM-6 COMPUTER COMPLEX

Tashkent ALGORITMY [Algorithms] in Russian No 37, 1979 pp 40-43

ARTYKOV, S., BOLTAYEV, B. D. and INOYATOV, A. I.

[From REFERATIVNYY ZHURNAL: AVTOMATIKA TELEMEKHANIKA I VYCHISLITEL'NAYA TEKHNIKA No 11, Abstract No 11B90]

[Text] Development of a standard program of data conversion within a computer complex consisting of two machines, an M-22A and a BESM-6, is considered here. It is shown how the algorithm of converting negative numbers and logic constants for data transfer within such a system has been implemented. References 5.
[179-2415]

2415
CSO: 1863

USSR UDC 681.322.068

METHODS OF DESCRIBING LANGUAGES AND TRANSLATIONS IN MODERN TRANSLATOR DESIGN SYSTEMS

Moscow PROGRAMMNOYE OBESPECHENIYE BANKOV DANNYKH [Programmatic Software for Data Banks, Proceedings of the All-Union Seminar] in Russian 1979 pp 79-82

KURYSHEV, A. V.

[From REFERATIVNYY ZHURNAL: AVTOMATIKA TELEMEKHANIKA I VYCHISLITEL'NAYA TEKHNIKA No 11, Nov 79 Abstract No 11B88 by V. A. Tantsyura]

[Text] A translator design system is some technology of producing large programs, with whatever degree of automation, which either directly leads to the construction of a translator or can be effectively enough utilized for this purpose. There are several approaches to the task of producing a translator design system: algorithmic, projective and linguistic. In the algorithmic approach a translator design system is produced by linguistic and programmatic means which make the task of describing the translation algorithms easier for the user. In the projective approach one first of all establishes a correspondence (projection) between objects in the input language and in the output language of the translator. This task is separate from development of a procedure for realization of this correspondence. In the linguistic approach one assumes to have a full description of the input language and the output language, the two unconnected to each other, whereupon one constructs the translator on the basis of these languages. This report analyzes the methods of language description and translation in existing translator design systems and, particularly, defines those three approaches. Modern translator design systems fall into three basic groups: compiler compilers constituting the largest group and essentially based on experimental studies, instrumental systems used most often for construction of practical translators, and interpreter design systems. Considered are also methods and means of describing translators or rather, more precisely, translator tasks which must be formulated for the translator design systems of each group. Examples of compiler compilers are analyzed using as an example the O. Leckart system, DELTA KOPS and the affiliated with them W. Arthur system. Examples of instrumental systems are MASON and the R-technology, which represent different realizations of the algorithmic approach. As an example of an interpreter design system is considered SEMANOL. In conclusion, it is noted that many new procedures are being developed for producing translator design systems. However, only a few of the known translator design systems (I. Lehman system, RTK) are used in practice. [179-2415]

2415
CSO: 1863

USSR UDC 681.518:519.878

'SINKHRON-2' DATA SYSTEM. MEANS OF BATCH PROCESSING

Moscow INFORMATSIONNAYA SISTEMA SINKHRON-2. SREDSTVA DLYA PAKETNOY OBRABOTKI ['Sinkhron-2' Data System. Means of Batch Processing] in Russian 1979 64 pp

KRUTASHOV, V. V.

[From REFERATIVNYY ZHURNAL: TEKHNICHESKAYA KIBERNETIKA No 11, Nov 79 Abstract No 11.81.598 K]

[Text] The principles and the facilities of the Sinkhron-2 data systems for a BESM-6 computer are described. Its basic components include a generator of reports, a program for introduction of changes, a program for conversion and sorting, and a generator of descriptions. Data are stored on tapes or disks in sequential files of fixed recording length. Sinkhron-2 operates in the DISPAK operational system. Means of batch processing are also described.
[178-2415]

2415
CSO: 1863

USSR UDC 621.165:62-50+007

AUTOMATION OF PLANNING AND THE TASK OF AUTOMATION OF PROCESSES AND DESIGN OF TURBINES

Moscow ENERGOMASHINOSTROYENIYE in Russian No 12, Dec 79 pp 4-7

[Excerpts from the article by L. Shubenko-Shubin, Academician, Ukrainian Academy of Sciences]

[Excerpt] The primary properties and qualities of turbines are determined to a great extent in the first stage of their creation--the planning stage. However, the method of planning of turbines, in comparison to the overall rates and scales of technical progress, have changed but little, in spite of the fact that the basic principles of turbine design were laid down many decades ago, when the designer had at his disposal a very limited volume of scientific and technical information, with nothing more than a slide rule and mechanical adding machine as hardware.

The basic hardware of SAPR (System of automated planning of machines) consists of a machine processor, a large capacity computer. According to preliminary estimates, automatic planning systems for turbine installations require machines with operating speeds of at least 10^6 operations per second, corresponding to the capabilities of third generation machines and the new YeS-1050 and YeS-1060 machines. However, the main memory of these machines must be supplemented by additional memory units. An approximate diagram of the equipment in an automatic planning system is shown in the figure with this article. The overall system developed at the Institute of Machine Building Problems, Ukrainian Academy of Sciences, consists of models and programs, plus subsystems for determination of the relative elongation of elements of the unit, limiting the area of selection of axial and radial clearances in the flow-carrying portion.

[182-6508]

6508
CSO: 1863

ECONOMIC APPLICATIONS

General Treatment

PROBLEMS OF ASU INTERACTION

Moscow PLANOVOYE KHOZYAYSTVO in Russian No 11, 1979 pp 67-73

[Article by I. Sokolov, sector head of the All-Union Scientific Research Institute of Problems of Organization and Control, State Committee for Science and Technology]

[Text] In the resolution of the CPSU Central Committee and the USSR Council of Ministers, "On improvement of the planning and intensification of the effect of the economic mechanism on increase of the effectiveness of production and the quality of work," special attention was turned toward raising the level of planning work in the national economy. The following were acknowledged to be the most important directions in the improvement of all planning work: the selection of the most effective ways to achieve high final national economic results; a rational combination of sector and territorial development and of long-range and current plans; improvement of inter-sector and intra-sector proportions, and assurance of balanced growth of the economy.

In the existing system of management of the national economy definite forms of functional interrelations have formed on the basis of regulated exchange of data obtained as a result of the solution of economic problems. The effectiveness of joint work of planning and economic agencies is determined to a great extent by the coordination of processes in the preparation and adoption of coordinated planning decisions.

The final result of planning--a balanced long-range or current plan for the development of the national economy--can be obtained only when there is a methodical and organizational linkage of the actions of agencies of national economic, sector and territorial planning.

Improvement of methodical work on individual sections of the planning and economic activity of the apparatus of ministries and departments is not sufficient for qualitative shifts that increase the effectiveness of planning of the national economy. It is necessary to steadily bring to life a systems organized complex of measures to intensify the integrity of procedures in the preparation of planning and economic decisions.

The planning and authoritative functions are very closely interwoven in the structure of agencies of management of the national economy. It is practically impossible to describe the procedure of organization and the methodology of the work of the apparatus separately from one another: the methods of solving problems, the methods of evaluating and coordinating decisions between agencies of administration. Insufficiently rapid refinement of the procedure and conditions of interaction of the planning and economic agencies can be reflected negatively on the effectiveness of realization of measures to improve management in individual sectors of social production, taking into consideration the constant expansion of the use of means of automated data processing in them.

To clarify the essence of the problem of interaction under conditions of improvement of the forms and methods of planning management of the economy on the basis of the creation of automated control systems, let us examine a given economic agency as a link in the system of management of the national economy. In the economic and organizational aspect the effective realization of measures entrusted to that agency is possible if there is sufficient information for decision making and the following have been determined:

the methods of performing the principal functional tasks;

the structure of the subdivision over which the functional tasks and the competence to solve them are distributed;

personnel of the administrative apparatus who participate in the preparation and making of decisions;

the entire set of legal norms establishing the procedure and rules for the functioning of the administrative agency.

The introduction of computing technology and the creation and development of automated control systems have brought about a need to impart greater completeness not just to the economic and organizational construction of an administrative agency. It also is necessary to regulate the technological processes connected with data processing for planning, accounting and administration.

Consequently the rationalization of the planning and economic activity in the creation of an automated control system consists in improvement of the following elements:

the methods and procedures of complex data processing with the aid of the means of mechanization and automation;

information requiring reduction in accordance with the effective technology of data transformation (including when necessary the creation of specialized languages for communication with the computer, data storages, etc);

subdivisions that assure reliable work of hardware and of specialists with a technical profile;

complexes of means that carry out the technological process of data reception, processing and transmission;

the entire set of normative documents that establish the correct procedure of new technology of information servicing of the administrative apparatus.

When measures to improve the administrative activity of a ministry and a department are oriented toward rationalization of separate elements of the economic and organizational aspect (improvement of the structure of links of sector administration) or the technical and technological aspect (the development of automated data processing systems), the interaction of the administrative organs is accomplished in practice within the framework of the forms of joint planning activity that have formed.

With the attribution of complexity to work on improvement of administration a need for interdepartmental coordination of measures connected with raising the level of joint planning and economic activity becomes obvious. Otherwise the lack of coordination of organizational and methodical principles of rationalization of planning work can become a hindrance to the improvement of the system of national economic planning as a whole.

The problem of interlinking work in the area of improvement of planning functions has been formulated very completely in planning materials on the creation of an automated control system for planning calculations [avtomatizirovannaya sistema upravleniya planovykh raschetov--ASPR]. Determination of the ASPR as the system for calculations of national economic plans and the monitoring of their fulfilment poses from the very start the question of unification of the processes of planning on the national economic, sector and territorial levels and coordination of the work of all planning agencies and planning subdivisions of ministries, departments and territorial organizations. In decisions on creation of the ASPR the macromodel of the system for development of the long-range, medium-range and current plans is constantly refined and the most important planning functions of the ministries and departments are determined.

The coordination of work to assure the interaction of the ASPR with the ASU encounters a number of difficulties resulting from existing methodical and organizational principles, on which the contemporary development and evaluation of the technical level of related ASU's are based, and especially sector ASU's (OASU). The planning decisions for most ASU's of ministries and departments, oriented toward satisfaction of those principles, still contribute weakly to solution of the problem of statewide integration of systems in the processes of planning.

The problem of methodical unity of the planning and economic calculations made within the frameworks of the created ASU's is no less acute. It is obvious that the completeness and continuity of the processes of planning control must be assured by determining strictly coordinated and mutually coordinated complexes of tasks that embrace interacting ASU's. However, the organization of joint planning of sector ASPR subsystems and OASU

subsystems that solve planning tasks encounters serious difficulties. One reason for that is the existing practice of estimating the technical level of the sector and departmental ASU's that are being created.

The technical level of development of present-day ASU's is usually estimated by the number of solved tasks and subsystems. Such an approach stimulates the development of as large as possible number of locally solved tasks. This shortcoming is manifested especially acutely in planning, since a contradiction arises between the requirement for the best quality of planning, determined by the joint activity of the functional links of the administrative apparatus, and its embodiment in groups of scattered automated planning calculations.

The complexity of planning activity under ASU conditions is destroyed as a result of the presence of algorithmically insoluble procedures for the analysis, evaluation and correction of formalized calculations. Such a situation results from the use of present-day computers almost everywhere in package data processing conditions. Such conditions, however, with rare exceptions (in summary calculations) are in principal unacceptable for planning. The use of package processing leads to lag of planning calculations behind current planning work and to consolidation, but not to improvement of the traditional forms and methods of planning. The developers themselves acknowledge the irrationality of using that method in planning processes.

At the present time only pre-planning tasks can be encountered in planning decisions for OASU and ASPR. According to the available data, less than 3 percent of tasks of that kind have been introduced into 12 sector ASU and in only 2 OASU has their number been reduced to 80-90 (20-30 percent of the total number of tasks recommended by the OASU Standard Technical Plan).

If one sets aside references to difficulties in the creation of ASU's caused by poor development of the information, mathematical programming and technical bases, a shortage of highly qualified specialists in systems designing, etc, one can point out weightier reasons for the unsatisfactory use of ASU's in ministries and departments in the solution of planning tasks: the absence of serious interest in the essence and tasks of planning, orientation toward the solution of disconnected tasks and the designing of systems without consideration of their subsequent standardization in processes of planning administration. It is no accident that the system-forming elements of present-day ASU's include only information, technical and mathematical programming provision, in essence characterizing a system that functions within an administrative agency and does not assume interaction with the external environment.

The conditions of compatibility of systems have not found sufficient reflection in the materials regulating the development of an OASU. They do not contain strictly defined requirements for the consideration of planning decisions adopted in the creation of ASPR's. For example, the absence in

the OASU structure of links joined with summary and sector ASPR subsystems, the ASFR [automated system for management of financial calculations] of the USSR Ministry of Finance, the ASOI TsEN [automated system for the processing of information on prices], the ASU of the USSR Gosplan and other ASU's, or the scattered development of such links can unfavorably affect their interaction. The problem of assuring the structural unity of systems and the organizational unity of their development has to be solved in the very near future.

The purposive approach to the development of ASU's is based on certain principal positions that regulate the procedure of designing and the conditions of functioning of an automated system in each stage of its development. The development of the system itself is directed toward the realization of two very important goals: very complete use of the information and computing possibilities of an ASU in the interests of the administrative agency, and integration of a given system with other ASU's, which assures effective exchange of information in the structure of links of the system of planned management of the national economy.

In the development of any automated system of organizational control one should start from the following principles:

--the system of complex national economic planned control is regarded as a developing whole that assures the organic unity, succession and interconnection of all stages and forms of centralized planning, administration and monitoring of the sphere of social production;

--in the processes of improvement of the system of planned management the role of computer hardware and methods of automated collection, accumulation, processing and issuance of data is reduced to very complete automation of processes in the preparation of economic decisions coordinated with respect to the levels and subdivisions of planning and management of the national economy;

--the development of automated systems is considered in two aspects, that of time (stage), which takes into consideration the methodology of national economic planning and management in the structure of state administrative agencies, and in that of functioning, which assures the most effective use of the information and computing potential of a system in each stage of its creation.

An automated system developed on the basis of a purposive approach in the interests of the general economic, sector or territorial management is regarded as an element of a system of planned management of the national economy. The tasks solved by it, as a rule, must embrace one or several functions of national economic management. The main functions of national economic management under the conditions of ASU development must be considered interconnected complexes of tasks in the planning, record keeping and monitoring the execution of planning tasks. Such complexes also form very close information exchange, which represents the basis of the interaction of integrated ASU's. In that sense it is advisable to distinguish the following intersector complexes of tasks:

--the planning and management of scientific and technological progress;

--the planning of the development of the production and technological base of the national economy--capital construction;

--the planning of material production, including the standardization of production, control of its quality and the distribution and consumption of material resources of the national economy;

--the planning and regulation of the circulation of finance and credit, including price formation;

--the planning of the preparation, distribution and use of labor resources, including their socio-cultural development;

--the planning and management of foreign economic and foreign trade relations;

--planning in the sphere of the protection, restoration and use of natural resources.

These complexes of tasks of national economic planning should be regarded as the basis of the formation of the economic organizational structure of a specific ASU of a ministry, department, territorial agency, enterprise or institution.

In the organization of planned management under the conditions of an interacting ASU the ASPR of the USSR Gosplan is called upon to play a special role, the direction of the development of which ought to be determined by the main design decisions on the creation of other automated systems of general economic (ASU of the USSR Gossnab, ASU of the State Committee for Science and Technology, ASUtrud [expansion not given], ASFR of the USSR Ministry of Finance, ASU of the USSR Gosbank, ASU of the USSR Gosstroybank, etc) and sector management of industrial, construction, agricultural, transport and other subdivisions of the national economy.

A very complex problem of the organization of ASU interaction is the formation of a complex (interdepartmental) aggregate of tasks that assure coordinated planning decisions. Such integration can be accomplished by information exchange between ASU hardware combined in a network. However, the variety of possible exchange regimes requires that the ASU structure vary as a function of the intersector planning task to be solved in the given period. In that case the organization of information exchange regimes will consist in the development of successive series of standard procedures of data transmission and processing on the basis of general system orders that establish joint functional and technological regimes. The most important of them are the character of the operating regime, determination of the set of ASU interacting in the given regime, the list of the presented document files, the procedure and times of data exchange, and also the rules of coordination of the results of solutions obtained in different ASU's.

Of special importance in ASU integration is the creation of a single hierarchic network of computer centers that can be regarded as the information-technological base of interacting automated systems. With the unification of all computer centers into a single system the solution of general planning tasks will be a result primarily of the presence of a standardized mathematical program and data fund of the interacting ASU's, formed on the basis of system-organized data banks.

At the present time a number of systems (the "Sirena," "Express," the ASU AZLK [expansion not given], etc) have already replaced the package processing of data by direct remote processing. Excluded in these systems is the local processing of separate data files; designing is regarded as reconstruction of the process of management. All the data needed for the performance of certain management functions are in the banks of the system. The use of third-generation computers in such ASU's has permitted organizing the data processing regime on a real time scale and accomplishing a dialog (interactive) working regime of man with machine. The advantages intrinsic to ASU constructed on the indicated principles consist in the following: a radical shortcoming of now widespread ASU's, the arbitrary selection of tasks, is eliminated; processes of planning calculations are integrated; the prerequisites are created for transition to purposive methods of planning; the possibility of effective interaction of administrative links is assured.

At the present time a methodology of creating ASU's within the framework of the purposive approach has not been worked out. Evidently this can explain the slow penetration of the ideas of complexing, integration and interaction into design decisions of an overwhelming part of the sector ASU's being developed. It seems to us that the elimination of existing shortcomings can be helped by solving, firstly, the problem of giving organizational and economic unity to all ASU's engaged in processes of planning management and, secondly, the problem flowing from it in reviewing the indicators for estimating the technical level and economic effectiveness of developing ASU's. In solving those problem the leading role of the ASPR in the system of planning the national economy should be taken into account. It is necessary in that case to temporarily limit expansion of work on the creation of ASU's in agencies of management and concentrate attention on the development of leading ASU's joined with ASPR's.

In development stage II of the ASPR line the interaction of ASPR's and ASU's of ministries and departments must be designed as a functionally and technologically integrated process of joint data processing and their subsequent use in solving problems of national economic planning. The main task is experimental processing of standard technological schemes for the interaction of ASPR's and ASU's of ministries and departments. The best prepared for its solution are such systems as the ASU of the USSR Gosplan, the ASU of the Ministry of Light Industry, the ASU of the Ministry of Instrument Making, Automation Equipment and Control Systems and the ASU of the Ministry of Foreign Trade. The organization of data exchange between

the distinguished group of ASU's and ASPR's must be directed toward the development of forms of joint functioning of ASPR's with ASU's of ministries, departments and territorial organization and contribute to a solution of problems in their interaction.

Methodical compatibility of ASPR's and ASU's is achieved the distinguishing of data processing complexes joined in pairs in a current planning regime, with a very complete bank of tasks. Information interaction of ASPR's and ASU's is realized on the basis of approved standardized forms of planning documentation, a single products list and also an effective system of indicators of state statistics. Technological compatibility is assured by the use of a basic scheme of organization of the information and computing process. Legal unity of ASPR's and interacting ASU's is achieved during the development, coordination and approval of a coordination plan of work of a paired connection of the ASPR with each ASU, the technical task in the designing of complexes of combined tasks, methodical instructions on the performance of work and documentation representing design decisions for introduction.

A purposive approach to ASU development requires an estimate of the technical level of its development that is different in principle. The indicators of the level of development must be regarded as planning indicators, accountable to the given system in each successive line of the given system. The following indicators can be proposed as such: the level of automation of the planning and administrative activity; the volume and structure of the integrated data base; lag of the data processing system in relation to the adoption of planning decisions; the degree of balancing of planning decisions; the rates of curtailment of document circulation, etc.

Those indicators ought to be supplemented by calculations of the economic effectiveness of the system. The existing procedure of such calculations, arbitrarily interpreting the concept of the economic effect, orients in its determination toward increase of production, reduction of cost, growth of labor productivity, etc. This permits attributing to the ASU any positive shifts occurring in a sector in the period of creation and introduction of the given ASU line, for example, the influence of new technology, improvement of the organization of production, growth of the capital-labor ratio, development of socialist competition, etc. Many ministries and departments are reporting on the introduction of ASU, having low indicators of use of computer hardware in the sector.

Realization of the proposals under consideration will permit going over to complex improvement of the national economic planning management on the basis of wide use of automated control systems interacting with ASPR's.

[137-2174]

2174
CSO: 1863

USSR UDC 681.5 : 62.5

AUTOMATED SYSTEM FOR TECHNOLOGICAL PLANNING OF MACHINING OF BLADES (ASTP "LOPATKA")

Moscow ENERGOMASHINOSTROYENIYE in Russian No 12, Dec 79 pp 20-24

[Excerpts from the article by L. I. Zal'tsman, Candidate in Technical Sciences, A. I. Katsnel'son and M. A. Chekh, engineers]

[Excerpt] The basic technical indicators of the system are as follows: maximum number of planned operations and transitions in planned operations unlimited in the archive of technological equipment; maximum number of operations on the path--80; capacity of working archive at least 1000 units of equipment; time to start up a new typical technological process 15 to 30 days (not including documents of system for preparation of initial basic information); time for coding of one blade--2 hours; machine time for output of operating technology of 30-40 operations--2 hours; minimum number of magnetic tape drives to start up new technology--4 (32 k main memory); software written in FORTRAN, KOBOL and YASK for the Minsk-32 computer.

[182-6508]

6508
CSO: 1863

USSR UDC 681.51:57

A DEVICE FOR NEURON SIMULATION

USSR Patent Class G 06 G 7/60 No 647,699 15 Feb 79 (disclosure No 2,385,492 14 Jul 76)

LYAKHOV, V. N. and SAMARIN, A. I., Rostov State University

[From REFERATIVNYY ZHURNAL: TEKHNICHESKAYA KIBERNETIKA No 11, Nov 79 Abstract No 11.81.546 P]

[Text] The invention relates to the field of bionics and can be utilized in adaptive data and control systems. A model of a neuron is already known which includes modules of controllable electrical conductance, integrators in excitation circuits for presynaptic and postsynaptic braking, and generators of excitation and stagnation output signals, which also duplicates such features of the biological prototype as fine adjustment of the weights of interneuron bonds, space-time summation, establishment of a membrane potential and generation of action potentials. Technically closest to the new invention is a device for neuron simulation which contains a space-time summation module, a controllable energy source and an adder. A deficiency of these components is their incomplete simulation of processes in a biological neuron, omitting several accommodative characteristics of the nerve mesh. More precise simulation is achieved by supplementing the model with an additional controllable space-time summation module, an initial conditions module, an interneuron bonds weight change module, an interneuron bonds weight correction module, a neuron threshold adaptation module and a controllable generator of impulses, with the input of this generator connected to the signal output of the threshold adaptation module and the control outputs of the latter connected to the first inputs of the weights correction module. The initial conditions module is connected to the first input of the threshold adaptation module and the second input of the latter is connected to the first output of the adder, whose first and second inputs are connected respectively to the outputs of the main controllable space-time summation module and the additional controllable space-time summation module. The control input of the main controllable space-time summation module is connected to the second output of the adder. Figures 1; references 2.
[178-2415]

2415
CSO: 1863

USSR UDC 681.323

AUTOMATIC TRANSFORMATION OF AN ARBITRARY FUNCTION TO A SYSTEM OF SHANNON EQUATIONS

Kharkov PROBLEMY BIONIKI in Russian No 23, 1979 pp 74-80

DYUBKO, G. F. and ZAMALEYEV, YU. S.

[From REFERATIVNYY ZHURNAL: TEKHNICHESKAYA KIBERNETIKA No 11, Nov 79 Abstract No 11.81.545 by V. T. Mitroshina]

[Text] The subject here is simulation of human activity involved in transforming mathematical relations written in a high-level language to a system of Shannon equations, i.e., to some form of machine-oriented language. Systems of Shannon equations for elementary functions are constructed and an algorithm is proposed for transforming an arbitrary analytically given function to the Shannon form. The performance of this algorithm is demonstrated on an example. Automatic transformation of arbitrary functions written in a high-level programming language to a system of Shannon equations raises the level of utilization of computer engineering apparatus such as digital integrating machines and structures. Figures 1; tables 3; references 3. [178-2415]

2415
CSO: 1863

INFORMATION SCIENCE

Information Services

USSR UDC [[002.53:025.2]:778.14.072]:65.011.56

AUTOMATED SYSTEM FOR FORMATION OF SMALL LIBRARIES OF INFORMATION SOURCES

Moscow NAUCHNO-TEKHNICHESKAYA INFORMATSIYA. Series 2 Information Processes and Systems in Russian No 12, Dec 79 pp 8-10 manuscript received 12 Jan 79

[Excerpts from an article by R. B. Askinazi]

[Excerpts] One promising trend in the development of information service is related to the use of microfiche containing sources of scientific and technical information. Microfiche has been highly evaluated by specialists and is currently being used both in the USSR and abroad to create automated information systems at various levels. One of the primary tasks performed in the process of creation of such systems is formation of the libraries of sources. A Pentax microfilming machine (East Germany) is widely used in the USSR and other CEMA member countries for this purpose.

The "Saratov" minicomputer, programmed compatible with the PDP-8 (USA), ISOT 0310 (Bulgaria), TRA-1 (Rumania) and Electronika-100 (USSR), is the technical basis for the system. The minimum machine system has been supplemented by two magnetic tape units based on YeS-9002 devices. This achieves information compatibility of the Saratov computer with the YeS computers. The operating system MOS-1 has been developed for work with the magnetic tape drives.

Information for the automated system consists of a data base stored on magnetic tape in a format based on the recommendations of the ISDS.

[182-6508]

6508
CSO: 1863

THEORETICAL FOUNDATIONS

General Problems

SPECIALIZED UNIFORM STRUCTURES AS PROGAMMABLE LOGICAL MATRICES

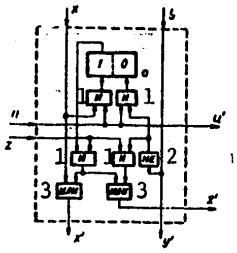
Riga AVTOMATIKA I VYCHISLITEL'NAYA TEKHNIKA in Russian No 6, 1979 pp 67-72

[Article by Ya. I. Fet]

[Excerpts] In works [1-4] specialized uniform structures intended to perform various mass search operations were proposed. An analysis of these structures shows that they can be used effectively not only for the purpose for which they were intended (i.e. for the solution of logical informational problems), but also for other types of processing of digital information. A number of issues related to the broadening of the range of application of specialized uniform structures are considered in [5,6]. This paper investigates the potential for using such structures as programmable logical matrices (PLM). The discussion relates to the (alpha) α-structure, although certain other specialized uniform structures also have analogous characteristics.

Figure 1 gives a functional-logical diagram of the α-cell. As was demonstrated in [1], in a matrix consisting of α-cells, the search for maximum (or minimum) numbers is realized in the apparatus, thus descending (or ascending) ordering can be performed. In [5,6] it is demonstrated that the α-structure can be used as a commutative matrix and an associative memory unit (ZU) which can be realized by various standard computer blocks etc.

As is known (Cf., e.g., review [7]), to construct a PLM it is necessary to create an input matrix to form the minterms (we will call this the AND-array) and an output one to form the disjunction of the minterms (we will call this the OR-array). One of the basic tasks involved in the synthesis of the PLM is to decrease the dimensions of these matrices while retaining the necessary functions in them. Interesting ways of minimizing the PLM are given in [8,9] and other papers. To achieve minimization it is proposed to make use of "neutral" states of the PLM cells. This makes it possible to describe functions with an abbreviated DNF (expansion unknown); additional input and output function generators are introduced, which makes it possible to deal with forms in parentheses etc.



Key: 1 - AND
2 - NOT
3 - OR

Рис. 1. Ячейка α-структуры.

Fig. 1. Cell of an α-structure

Conclusions

1. The programmable logical matrix is in some sense dual with regard to the associative processor. The associative processor performs parallel computation of the given function for the blocks of arguments. These arguments are registered in the cells of the uniform structure (associative memory unit/ZU). The necessary functional transformation is accomplished by a microprogram stored in the local control device of the processor. Usually the microprogram consists of many steps (micro-commands). The signals of the microoperations enter at the entry points of the circuit. When the microprogram has run, the blocks of results are in the cells of the cellular array.

The PLM performs the calculation of the given function for one argument (or one set of arguments), which are in the entry points of the circuit. The table corresponding to the necessary functional transformation is represented in the uniform structure by means of an appropriate configuration of the cells. The calculation of the given function is a primitive operation and is performed completely by the apparatus, with a speed determined by signal propagation time. The result is registered at the exit points of the circuit.

2. The α-structure may be used as a PLM and permits the use of various methods of minimization. As was shown in [5,6], the α-structure may also serve as storage matrix of the associative processor.

Since the α-cell permits the operative recording of information (configuration), a PLM based on an α-structure is programmable.

Using certain rows of the α-matrix as registers of internal states, it is possible to place a PLM with a memory in the α-structure. In the α-structure it is very easy to divide the PLM into independent horizontal edges of supply for certain features on two entry points at the left

boundary of the corresponding edges. This makes it possible, using any particular features of the arguments, to divide the whole region of determination into a series of intervals in order to simplify minimization within the edges, corresponding to each interval.

3. The α-structure, which was first proposed as a specialized (sorting) device, reveals the capability to perform various different functions: in it are effectively realized functions of associative memory unit (ZU), PLM, microprogram ZU, commutators, different blocks of computers and digital automata. This allows us to hope that the α-structure, realized in the form of special BIS (large-scale integrated microcircuits) can find wide use.

In conclusion, the author expresses appreciation to A. I. Mishin for his helpful comments.

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Received 2/14/79

[166-9285]

9285
CSO: 1863

USSR UDC 621.316.0-505:621.316.728

ONE POSSIBLE ALGORITHM OF OPTIMAL LOAD DISTRIBUTION BETWEEN REGULATING POWER DEVICES DURING AUTOMATIC DIGITAL REGULATION OF EXCHANGE POWER (FREQUENCY) IN A POWER GRID SYSTEM

Moscow TRUDY INSTITUTA ELEKTRONNYKH UPRAVLYAYUSHCHIKH MASHIN [Transactions of the Institute of Electronic Control Machines] in Russian No 71, 1978 pp 77-80

YERMAKOVA, V. I.

[From REFERATIVNYY ZHURNAL: AVTOMATIKA TELEMEKHANIKA I VYCHISLITEL'NAYA TEKHNIKA No 11, Nov 79 Abstract No 11A345 by V. Yu. Skobarev]

[Text] Let the total returning power ϕ to be regulated require a correction of the active power level in a power grid system by a certain amount. The problem is to establish settings at the plant with which deviations of power flow from the norm will be cancelled fastest without the constraints of static stability being violated (when the power blocks subject to regulation are of the same type, then the characteristics of relative increments can be disregarded). The problem reduces to one of determining the direction along which the rate of change of function ϕ approaches its extreme value as closely as possible, without any one constraint on the generation in the regulated plants and on the return flow of active power over internal lines in the power grid system having to be violated. References 3.
[179-2415]

2415
CSO: 1863

USSR UDC 629.7:519.87

SYNTHESIS OF METHOD FOR COMPUTING THE COORDINATES OF THE ORIENTATION VECTOR

Kiev KIBERNETIKA I VYCHISLITEL'NAYA TEKHNIKA [Cybernetics and Computer Engineering] in Russian No 43, 1979 pp 122-130

PANOV, A. P.

[From REFERATIVNYY ZHURNAL: AVTOMATIKA TELEMEKHANIKA I VYCHISLITEL'NAYA TEKHNIKA No 11, Nov 79 Abstract No 11A424]

[Text] A new approach is taken to the synthesis of methods for computing the coordinates of the orientation vector associated with a solid body, based on particular solutions to the differential equation of kinematics in matrix form for the coordinates of this vector and on applying here methods of numerical differentiation. Various methods of transforming increments of quasi-coordinates to coordinates of the orientation vector (methods of third-, fourth- and fifth-order strength) are shown, also a fourth-order method of integrating this equation when the angular velocities of the body are known. It is demonstrated that primary data on the motion of a body about the center of mass may preferably be (from the standpoint of precision as well as considering the volume of necessary computer calculations) expressed as quasi-coordinates rather than as coordinates of the vector of angular velocity. References 10.
[179-2415]

2415
CSO: 1863

USSR UDC 629.7:656.614

ALGORITHMS OF CONTROL OF AUTOMATIC LOADERS DURING LOADING OF A MULTIDECK CARGO SHIP

Moscow TRUDY INSTITUTA PROBLEMOV UPRAVLENIYA [Transactions of the Institute of Control Problems] in Russian No 15, 1978 pp 24-29

MARAKANOV, I. N.

[From REFERATIVNYY ZHURNAL: AVTOMATIKA TELEMEKHANIKA I VYCHISLITEL'NAYA TEKHNIKA No 11, Nov 79 Abstract No 11A420]

[Text] Algorithms of suboptimal scheduling of the operation of automatic loaders during loading of a multideck ship are examined here with the aid of a simulating model. The process of loading a 5-deck ship has been simulated on a computer and the results are also shown here. Figures 2. [179-2415]

2415
CSO: 1863

USSR UDC 658.012.011.56

STRUCTURE AND ORGANIZATION OF DATA FOR DESIGNING THE TOPOLOGY OF SPECIAL-PURPOSE LARGE-SCALE-INTEGRATION SYSTEMS

Moscow TRUDY INSTITUTA PROBLEMOV UPRAVLENIYA [Transactions of the Institute of Control Problems] in Russian No 15, 1978 pp 83-88

POPOZ, V. Z. and NEFEDOV, V. S.

[From REFERATIVNYY ZHURNAL: AVTOMATIKA TELEMEKHANIKA I VYCHISLITEL'NAYA TEKHNIKA No 11, Nov 79 Abstract No 11A325]

[Text] A method of designing the topology of large-scale-integration systems is outlined which aims at producing circuits with the optimum electrical characteristics. Described is also the structure of topological data which makes this method implementable in practice. Figures 2; references 3. [179-2415]

2415
CSO: 1863

GENERAL INFORMATION

Conferences

INTEGRATED AND SMALL COMPUTER SYSTEM EQUIPMENT AND ITS APPLICATION

Moscow PRIBORY I SISTEMY UPRAVLENIYA in Russian No 11, 1979 pp 9-13

[Article]

[Text] The International Specialized Exposition of "Integrated and Small Computer System Equipment and Its Application" was held from 15 June to 15 July 1979 in Moscow at the Exposition of Achievements of the National Economy of the USSR. The exhibit was devoted to the 30th anniversary of the formation of CEMA and the 10th anniversary of the organization of the Cooperation of Socialist Countries in the field of computer engineering.

A multisided agreement for cooperation in the area of development, production and application of computer engineering means was concluded in December 1969 for purposes of the creation and use of modern computers in the national economy based on the development of the economic integration and the principles of socialist sharing of labor by the governments of the People's Republic of Bulgaria, Hungarian People's Republic, the German Democratic Republic, the Polish People's Republic, the USSR and Czechoslovakia. In 1972 the Republic of Cuba was added to it, and in 1973, the Socialist Republic of Romania.

The necessity for combining efforts and industrial resources in the development of computer engineering arose from the fact that before 1970 the socialist countries produced more than 30 types of different, incompatible computers independently of each other with special sets of peripheral units for each machine and different incompatible software.

During the first years of cooperation of the socialist countries, the general area of work was defined, a united technical policy was developed, and the basic goals were formulated with respect to the creation of the Integrated Computer System.

At the present time the following computers are being manufactured: the YeS[1]-1010(Hungarian People's Republic), YeS-1021 (Czechoslovakia), YeS-1040 (German Democratic Republic) and YeS-1050 (USSR), that is, all of the computers pertaining to the Ryad-1 family; the modified Ryad-1 computers: YeS-1011 (Hungarian People's Republic), YeS-1012 (Hungarian People's Republic), YeS-1022 (USSR, People's Republic of Bulgaria), YeS-1032 (Polish People's Republic), YeS-1033 (USSR) and the Ryad-2 computers: YeS-1025 (Czechoslovakia), YeS-1035 (USSR, People's Republic of Bulgaria), YeS-1055 (German Democratic Republic), and YeS-1060 (USSR). A total of 193 products from the integrated computer system passed joint international testing.

In 1974 work was started on building the small computer system. Now 78 of the small computer systems have passed joint international tests and been introduced into series production, including four types of small computer system processors. There is a plan for the development of the small computer system (second phase).

Also 148 packages of applied programs have been developed cooperatively and have passed joint international tests: 140 for the integrated computer system and 8 for the small computer system.

Many various technical means of remote data processing have been created for the integrated and small computer systems (modems, multiplexers, subscriber stations, and so on) joined by a common systems architecture, united interfaces and exchange procedures.

As modern computer means were developed, built and introduced, the complex service system for them was organized and improved made up of national organizations with respect to all-around servicing (NOTO) of the member countries of the agreement. For effective use of the computer means in all countries personnel are being trained in specialized training centers equipped with modern aids and the required computers.

The overall commodity circulation of computer engineering means in 1978 among the member countries of the agreement increased by more than 16 times by comparison with the 1971.

The International Commission on Computer Engineering has defined the basic areas of specialization and cooperation in the development and production of computer engineering means for the period from 1981 to 1990.

The computer equipment is being developed and produced in the member countries of the agreement on the basis of united standards of the International Commission on Computer Engineering and in accordance with them.

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[1][Translator's note: YeS refers to the integrated system of computers.]

The International Exhibition of "Integrated and Small Computer Systems and Their Application" demonstrated the results achieved in the creation of computer engineering means and especially in their use in the national economy of the socialist countries.

This is not the first exhibition in our country of computer engineering. Thus, in 1973 there was an exhibit devoted to the first family of the integrated computer system which demonstrated the unity of the technical policy of the socialist countries in the development and production of computer engineering.

The exhibit of 1974 on "Automated Technological Process Control Systems" (TP-74 automated control systems) played an important role in the popularization of the advanced experience of the Soviet industry.

An important feature of the exhibition of 1979 was showing effective application of computer systems in the control of the economy, industry, science and many branches of the national economy.

The significance and the effect of computer engineering on the development of small branches of the economy, the rates of scientific and technical progress, the solution of many social problems are well known. There is no sphere of human activity, the efficiency of which would not depend on rational application of modern computer means, automated data processing and storage systems, and the control systems.

More than 130 automated systems operating in various branches and on different sites but constructed on the basis of the same standardized hardware and software of the integrated and small computer systems were shown at the exhibition.

The provision for organizational, procedural and engineering unity of the automated control systems has been successfully accomplished in the socialist countries by unity of technical policy. The exhibition convincingly confirmed this: the systems built in certain countries operating on engineering means produced in other countries; hardware and software developed by different ministries, harmoniously complementing each other, expanding the possibilities of the overall equipment complex; the general library of multipurpose and multiuse programs is continuously growing and becoming the property of all computer users, and so on.

The exhibition demonstrated that the integrated and small computer systems have all of the necessary hardware and software for the creation of automated control systems of the given complexity and for in practice any area of application.

At the exhibition of 1979, there was an exhibit for the first time explaining the functions and the capabilities of the service enterprises of the

socialist countries joined into an international system for centralized and all-around technical servicing which as it develops is taking on larger and larger volumes of operation.

The technical division of the exhibition was a multimachine computer center equipped with data preparation, input-output, representation and storage units.

The overall output capacity of the Ryad-2 integrated computer system machines shown in the technical division is about 4 million operations per second. The total memory on magnetic discs is 2800 Mbytes. Three remote processing systems -- based on connected YeS-8371 (People's Republic of Bulgaria) and YeS-8731.01 (Polish People's Republic) processors and the YeS-8410 YeS-8421 (Hungarian People's Republic) multiplexers -- combined with local terminals serviced six systems divisions arranged around the technical division in which specific systems for automation of organizational control, production control, planning and design, and science were demonstrated.

Four new operations systems (OS 6.1, OS 4.1, DOS 3 and DOS 2.2) control the computer processes on the machines of the integrated system.

The YeS 1060 (USSR), 1055 (German Democratic Republic), 1035 (USSR, People's Republic of Bulgaria), 1025 (Czechoslovakia), 1015 (Hungarian People's Republic) computers, two types of magnetic disc storage elements, YeS-5067 and YeS-5066-01 (People's Republic of Bulgaria), three types of magnetic tape storage YeS-5612, YeS-5003 and YeS-5012 (People's Republic of Bulgaria), telecommunication processors of two types YeS-8371.01 (Polish People's Republic) and YeS-8371 (People's Republic of Bulgaria), the YeS-2335 matrix processor, the data input-output units and terminals of more than 20 types were shown for the first time at the exhibition.

The central part of the exhibit of the technical division was made up of a two-machine VK-2-R-60 complex consisting of two YeS-1060 computers having a processor output capacity of more than 1 million operations per second and a ready-access memory of 4 Mbytes. The system provides for virtual addressing of the 16 Mbyte ready-access memory. Under the conditions of the exhibition, the YeS-8371.01 telecommunication processor (Polish People's Republic) and the YeS-8410 data transmission multiplexor (Hungarian People's Republic) servicing 64 and 16 communication channels respectively were connected to the VK-2-R-60 complex. Thirty external devices and terminals installed at the exhibition by means of which 53 different automated control system problems were demonstrated were connected through a remote processor, multiplexer and directly to the VK-2-R-60 complex.

The YeS-1055 (German Democratic Republic) module is a medium-class computer. Its speed is 450,000 operations per second, the ready-access memory size is 1 Mbyte (semiconductor memory). The machine contains

one multiplex and three modular selector channels, the carrying capacity of which is 1.5 or 3 Mbytes/sec per channel. At the exhibition the YeS-1055 computer serviced the AIDOS information reference system. In combination with the computer, in addition to the standard peripheral devices, the operation of the machine with an YeS-7054 plotter and the YeS-7602 microfiche data output unit was demonstrated.

The YeS-1025 (Czechoslovakia) computer is the youngest model of the integrated computer system. Its speed is about 60,000 operations per second, its ready-access memory size is 265K bytes, the external memory size (the Soviet YeS-5066 memory) is 100 Mbytes.

The YeS-1025 computer (just as the YeS-1015 [Hungarian People's Republic]) operates with the DOS 3 operation system built jointly by the specialists of the USSR, Czechoslovakia and the Hungarian People's Republic. The DOS 3 system organizes the multiprogram operating mode, remote access to the data, it has virtual addressing of the ready-access memory of 16 Mbytes, which significantly increases the effectiveness of using the small Ryad-2 integrated computer system by comparison with the Ryad-1 analog computers.

The YeS-1025 computer is outfitted with the card punch built by the Czechoslovakian Aritma plant and the input-output units built on the basis of the YeS-5074 flexible magnetic disc storage elements.

The YeS-1035 (USSR and People's Republic of Bulgaria) computer is a medium-class machine. It was demonstrated with the YeS-2335 matrix processor (People's Republic of Bulgaria) which for problems reduced to multiplication and inversion of matrices, develops a speed of up to 10 million operations per second (it increases the output capacity of the YeS-1035 computer by 34 times). The YeS-2335 processor is the first matrix processor in the integrated computer system. At the exhibition the YeS-1035 computer was equipped with the YeS-5066.01 (100 Mbytes) and the YeS-5067 (200 Mbytes) magnetic disc memories developed in the People's Republic of Bulgaria.

The YeS-1045 computer (USSR) is a medium-class machine. The average speed of its processor is about 700,000 operations per second, the ready-access memory sizes up to 4 Mbytes. The machine is compact, it is equipped with one multiplexing and five modular multiplexing channels. The operating efficiency is guaranteed by high technical parameters and the developed microdiagnostics. The machine includes all the necessary accessory devices. At the exhibition 50 terminals for demonstrating 20 systems and problems were connected through the YeS-8371.01 telecommunications processor to the YeS-1045 computer.

All of the first models of the all purpose computer complexes of the small computer system (SM-1[1] to SM-4) a broad nomenclature of peripheral devices for the small computer system -- the external magnetic disc and magnetic tape memories, both reel-to-reel and cassette, alphanumeric and graphical

[1][Translator's note: SM refers to small computer system.]

displays, series and parallel printers, couplers to the industrial site, remote couplings for connecting remote terminals and computers, multiprocessor and multicomputer couplings (permitting the construction of a computer network) and also modules for connection to the scientific equipment of the CAMAC system -- were presented in the technical division. Fragments of the multimachine computer networks were demonstrated. One version of the network consisted of a two-machine complex of the SM-3 and SM-4 connected together by an interprocessor coupling and the SM-4 connected to them by remote coupling means. At the upper level the YES-1055 computer was connected to the small computer system complex by means of an intermachine coupler. On the basis of the indicated network, a multipanel reel-time system and distributed information retrieval system were implemented.

The SM-1 and SM-2 all purpose computer complexes have high speed of 400,000 and 460,000 operations per second; their memory size is 32K and 128K words.

The SM-3 and SM-4 all-purpose computer complexes have speeds of 250,000 and 800,000 operations per second respectively; the ready-access memory sizes are 32K and 128K words.

The hardware and software for the small computer system in the first phase jointly with the integrated computer system permit in practice realization of multilevel and integrated automation systems for the majority of practical problems.

In the exhibit of the systems division, the achievements of the cooperating countries participating in the exhibition with respect to use of computer engineering in the national economy found reflection. Thirty-two automated control systems for various purposes (20 of them were developed in the USSR) designed for performing information computer operations to solve the problems of accounting, planning and control in the national economy were presented in the fragments.

Fifty scientific research and planning and design institutes and organizations of the ministries and departments from the various countries demonstrated the implementation of more than 150 problems of operating automated control systems.

In the subdivision "automated control systems of central and territorial agencies" the operating automated control systems of the state committees, ministries and departments were demonstrated: the central statistical administrations, the state committees with respect to science and engineering, the state committees on standards, Gossnab, the ministries of public health and a number of others.

One of the central places at the exhibition was given to important organizational forms of the use of computer engineering -- the collective application of computers: collective-use computer centers were presented which are the basis for the state networks of the computer centers

and designed for servicing many enterprises, organizations and institutions from the remote subscriber stations independently of their departmental ownership.

The indicated complex automated information reference systems provide the state agencies, the scientific research or planning and design institutes, the design offices, and scientists with information and scientific-technical and generalized factographic information, including with the organization of international exchange of this information.

The application of the integrated and small computer systems in the system of territorial control agencies was demonstrated in examples of the operation of the ASU-Urozhay [Harvest Automated Control System], ASU-Zootekhnika [Zoological Engineering Automated Control System], ASU-Oblzdrav [Oblast Public Health Automated Control System], ASU-Gorzdrav [State Public Health Automated Control System], and the ASU-Bol'nitsa [Hospital Automated Control System].

The use of computer engineering in the enumerated regions provides an important social and large-scale cost benefit. For example, the centralized control system developed in the USSR (in Saratov Oblast) for the transport-procurement processes during the gathering of the harvest made it possible to increase the productivity of motor transportation by 30% on the average, and to release more than 1500 motor vehicles in the oblast during the harvest for other agricultural work.

One of the basic exhibits of the "Sector automated control system" subdivision was the standard machine building Sector control system -- in the example of the ASU-pribor [Instrument Making Automated Control System] (USSR).[1]

The Sector automated control system of the Ministry of the Coal Industry of the USSR -- OASU-Ugol' -- which was presented at the exhibition, consists of 18 relatively independent subdivisions.

The Main Computer Center of the USSR Ministry of the Coal Industry, Information Dispatch Station (IDP) of the USSR Ministry of the Coal Industry, the Main Computer Center of the Ministry of the Coal Industry of the Ukrainian SSR, 30 information computer centers in the production asscciations and 4 at the machine building plants are in operation in the oblast. The Main Computer Center and the Information Dispatch Station of the USSR Ministry of the Coal Industry have telegraph communications with the territorial associations.

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[1]"Automated instrument making Sector control system -- ASU-pribor: Thematic Selection," PRIBORY I SISTEMY UPRAVLENIYA [Control Systems and Instruments], No 1-3 and 5, 1976.

Among the complexes of problems realized under industrial conditions — annual and monthly planning, operative accounting and analysis of the activity of the enterprises, accounting and analysis of the activity of the enterprises, accounting and analysis of the operation of the working faces, monitoring the production of the working face front, planning the plant preventive maintenance and repairs, wage calculations, accounting for materials and fixed capital, accounting and analysis of the composition of the administrative staff, monitoring the business production and the system for observing variation of productive capacity of the coal enterprises.

The "automated dispatch control system of the integrated power system of the USSR" (ASDU YeES, USSR) was an important exhibit at the exhibition.

The integrated power system (YeES) of the USSR is a unique power association which supplies the national economy with electric power over a territory with a population of more than 200 million people. The dispatch control of the integrated power system of the USSR is realized by a hierarchical system with a large number of links, and it encompasses all levels of control of power engineering: the individual power unit -- power system -- power association -- the integrated power system as a whole.

The functioning of this system essentially improves the operative dispatch solution of the problems of long-range, current and operative control of the operating conditions on all levels, insuring the required qualitative electric power, economy and reliability of operation of the power systems and the power association.

The possibility of conducting an information dialogue with the computer using video terminals shown at the exhibition of the Sector automated control system of the Ministry of Electronics and Electrical Engineering of the German Democratic Republic also provides for the development and the distribution of state planning assignments among the Sector enterprises; planning and population of the requirement and production budget (with respect to materials, equipment and production output); planning of the basic technical-economic indexes of the Sector and individual enterprises; the output of information about the market situation, the data required for performance of the analysis in the enterprise section and also with respect to basic types of activity (realization of the mentioned problem was demonstrated at the exhibition) and information about the monitoring of the times for execution of the directives.

The YeS-7927 video terminal built at the Robotron enterprise and the subscriber station permitting operative data transmission from the enterprises to the central computer were shown at the exhibit.

The system for information servicing of the ministry and enterprise workers was presented as part of the Sector automated control system of the Ministry of Machine Building of the Polish People's Republic. The interaction of the user and the computer is realized through video terminals produced by the MERA enterprise.

The system handles the preparation, correction and output (on demand from the user) of information, including subject analysis and numerical data on the situation at the individual enterprises and in the Sector as a whole. The information in the data bank is separated into divisions described using the list of questions permitting detailed information to be obtained.

In the systems division the automated enterprise control systems of the various Sectors and with different nature of production were demonstrated.

The ASU-KamAZ [Kama Automobile Plant Automated Control System] was represented by a fragment at the exhibition -- the data gathering and processing system. The production data gathering system is based on using a new complex of means for the preparation and transmission of data -- the KSPD-1 based on the SM-1 all-purpose computer complex. The primary accounting indexes of the production code (the movement of parts, assemblies, materials, the condition of the equipment) are introduced from the RI-6402, RI-6401, RI-2401 data recorders by punch card input and the input of variable data from the keyboard. The panel recorders are installed directly at the locations for the appearance of the data (in the work areas, in the workshop facilities, the expedition, the warehouses of the dispatch planning office). The introduced information is program checked for correctness of format and logical reliability.

The collected information goes through primary processing on the SM-1 computer and is recorded on its disc files in a form that is convenient for the organization of a retrieval system and data transmission to a higher level computer (of the integrated computer system).

The ASU-KamAZ control system was implemented on the basis of the technical means of the integrated computer system, the RI-7501, RI-7701 registers. The set of problems encompasses operative control of the basic and auxiliary production, material and technical preparation of the production facility, technical-economic planning, market control, material and technical supply, and so on.

The basic solutions with respect to automation of control of technological processes in one of the most labor-consuming production facilities -- in the weaving production of the textile industry -- found reflection in the exhibition.

The technological process of the weaving production (the warp, sizing and weaving), the local automation means, sensors and signal units (displays),

the peripheral devices installed directly in the work areas of the assistant foremen and foremen were shown on the horizontal field of a mockup, on the vertical field of which the control levels and information formulated for them were presented.

In the system provision is made for operation quality control and certification of the lots of yarn, warps and pieces of unbleached cloth with the presentation of the basic claims against the suppliers of the raw material and intermediate products; stabilization of the most important technological parameters of the processes -- moisture, draft and adhesion of the warps, fabric density, tearing strength of the threads, the high speed modes of the machines; operative appearance of loom breakdowns.

Under the conditions of automated control, the production personnel are freed of performing operations with respect to gathering, formating and transmitting information; the organization of the work of the repair personnel is improved as a result of centralization of the operative dispatch control functions.

In the technological process automated control system (ASU TP) the optimal path of the fabric is calculated, and the path recommendations are output on a display.

Weaving automated control systems have been introduced at the Moscow Krasnaya Roza Silk Combine, the Darnitskiy Silk Combine in Kiev, at the Ivanovskiy Blending Combine and the rebuilt weaving plant imeni 8th of March (first phase) in the city of Ivanovo.

The introduction of the system permits improved production quality, a 30% increase in productivity of labor of the production personnel, a 4 to 5% reduction of equipment idle time, a 4 to 6% increase in the production sales volume increment.

Among the automated control systems for the projects of a nonindustrial sphere, a number of automated control systems for city management of Moscow were shown at the exhibition: the ASU-Inzhstroy [Construction Engineering Automated Control System], ASU-Sangigiyena [Sanitation and Hygiene Automated Control System], ASU-Bol'nitsa [Hospital Automated Control System], and RAIS-Kuntsevskogo Rayon [Kuntsevskiy Rayon Control System].

The ASU-Sangigiyena permits objective monitoring of the condition of the atmosphere at the industrial enterprises of the city. As a result of the operation of this system there is a possibility of estimating the concentration of harmful materials in the air of the production facility and taking the required measures to eliminate them.

Objective planning of the construction and installation operations, timely decision making with respect to the distribution and redistribution of

construction machinery and materials with respect to the construction sites insure construction success. The displayed ASU-Inzhstroy system automates decision making with respect to the control of a large consolidated construction organization.

The control of individual branches of the national economy without considering the territorial aspects and factors of rayon significance is insufficiently effective: it does not provide the required coordination of operations among the enterprises and services of the various Sectors, it makes incomplete use of resources, and in the final analysis the residents do not fully receive the services of the city administration. The indicated deficiency of administration is met by organization of control on the municipal rayon level. The automation of the functions of the administration of the rayon agencies of power is realized with the help of the rayon automated system (RAIS). The RAIS-Kuntsevskogo rayona demonstrated the possibilities of systems of this type.

The application of the computer complex based on the SM-2 computer and a network of DM-500 and DM-2000 video terminals was shown for the automation of the operative control of technological processes with respect to preparing trips at the civil aviation airport.

The automated control systems for passenger and freight hauling (the solution to individual problems was illustrated at the exhibition) are designed to automate a number of technological operations and also the functions of operative planning of the preparation of the aircraft and control of them, arranging for the commercial loading of the trips to reduce the overall time to service them, expansion of the use of the operational capabilities of the aircraft fleet, reduction of the number of trip delays to a minimum, improvement of the culture of servicing the passengers.

Each of the investigated systems is a multisubscriber local automated control system functioning in a real-time scale with interaction of the subscribers with the data processing center (TsOD). Here the reaction time of the data processing center to a subscriber request must not exceed 2-10 seconds depending on its priority.

The mentioned systems include organizational control systems (accounting, reporting, operative planning -- problems solved under background conditions) and the control of technological processes (registering and informing passengers, putting together cargo, time monitoring of the execution of the individual technological operations -- problems solved in the dialog mode).

The methods, the capabilities and results of using the computer engineering of the CEMA member countries to control the production processes directly were clearly demonstrated in the "automated technological process control system" subdivision.

The displays in this division were 12 technological process automated control systems implemented in industry in the People's Republic of Bulgaria, Hungarian People's Republic, Republic of Cuba, Polish People's Republic, the Socialist Republic of Romania, the USSR and Czechoslovakia. It is natural that this is a very small selection of the overall variety of modern processes, but the exhibits demonstrated sufficiently representatively and naturally the modern capabilities of computers in systems for improving efficiency and quality of direct production control.

The standardization of computer engineering in the member countries of the CEMA has predetermined the practical basis for their cooperation in a theoretically new area -- the development and introduction of the technological process automated control systems. Scientific and technical cooperation has become possible as a result of the experience accumulated by the specialists of various countries, proof of which was the control system of the Yelatsite Enrichment Plant (ASU Kontsentrat) created jointly by the specialists of the USSR and the People's Republic of Bulgaria and the Polish-Soviet Automated Control System for high-tonnage production of sulfuric acid (ASU Kupol-UM) which were demonstrated in the investigated subdivision. Both systems are distinguished by high scientific and technical level of development and application of the latest equipment.

The Soviet Automated Control Systems for the unique rolling complex of the Nizhnetagil' Metallurgical Combine imeni V. I. Lenin and the power unit of the Kostromskaya State Regional Hydroelectric Power Plant were distinguished by originality and depth of technical development of automatic control.

The complex control system for the process of manufacturing precision cast parts (USSR), the automated control system for sugar production (the Republic of Cuba), the automated technological process control system based on the small computer system in cement production and vitamin production (the USSR), automatic control system for working metals (Polish People's Republic, USSR) were demonstrations of one of the most effective areas of the use of modern computer engineering for the automatic control of technological processes.

The technological process automated control system for the rolling complex at the Nizhnetagil' Metallurgical Combine imeni V. I. Lenin (USSR) encompasses all the basic technological functions and the blooming mill 1500 and universal bar mill sections. The automated control system includes 6 universal computer complexes, about 200 specialized devices for local automation and more than 500 sensors of technological parameters. The automation of control provides a 2% increase in output capacity of the blooming mill, 15 to 20% for the bar mill, savings of gas and electric power, and improvement of production quality. On the operating model under the control of the SM-2 computer, the problem of following the course of the rolling of an ingot was demonstrated.

In the technological process automated control system for a 1200 Mwatt power unit at the Kostromskaya State Regional Hydroelectric Power Plant

computer engineering is used to monitor more than 1500 technological parameters, process data for the control of several hundreds of servo-mechanisms and to regulate the parameters with respect to 200 circuits.

The system automatically formats the operative information, it calculates the technical-economic indexes, it analyzes the use of fuel and records emergencies.

Among the exhibits at the exhibition were the hardware and software for the petroleum extraction enterprises (Hungarian People's Republic) providing for the possibility of constructing hierarchical automated control systems for the monitoring and control of technological sites distributed over a large area; the automated control system for the section of metal working machine tools and industrial robots (Polish People's Republic) performing automatic selection of parts and the sequence of machining them, the control of the technological machining program, the accounting (the system can include up to 16 devices with digital program control; a full-scale model of the digital program control was presented with a transport robot); the technological process automated control system for the manufacture of precision parts for rolling equipment (USSR), computer-controlling the entire process from the making of the drawing to production of the part (examples of making drawings and the types of parts manufactured were demonstrated).

The automatic planning and design systems (SAPR) realized using the integrated computer system, the small computer system, the problem-oriented complexes of ARM machines and standard operation systems are designed for the automation of planning and design work of the various branches of industry.

In the SAPR subdivision the USSR presented the following: an integrated planning and design automation system (YeSAP) for computers; the ARM; the broad-purpose graphical complex of the small computer system; automation of planning operations in construction.

The YeSAP EVT [integrated planning and design automation system for computer equipment] was built and is continuing to be improved by the joint efforts of the member countries of the CEMA participating in the development and manufacture of the integrated computer system.

The system will be used in building large computer systems with a volume of up to 10 million integrated circuits.

The YeSAP EVT realizes by automation means the processes of the design and checkout of computers, including simulation, diagnosis, planning and documentation of various circuits and individual structures. The documentation system is constructed so that it automatically prepares and monitors the finished product with a significant decrease in expenditures on the technological preparation of production, as a result of which the

process of the assimilation of the products in series production is accelerated, and production quality is improved.

The software for the system is based on the technical means of the integrated computer system. The selected principle of constructing the system will permit its functional capabilities to grow with multifaceted participation of the developers.

Part of the software for the system was shown at the exhibit permitting use of the dialog mode to prepare the initial design data, monitor the correctness of the circuitry, correct the circuitry, automatically create control tests, simulate the circuits, design individual structural assemblies and output the design part of the documentation.

The ARM was developed jointly by the enterprises of the Ministry of the Radio Industry and the Ministry of Instrument Making.

The complex shown based on the SM-3 universal computer is the SAPR terminal. The composition of the technical means of the ARM guarantees performance of operations with respect to graphical and alphanumeric information input, representation of it on the screens of the graphical and alphanumeric displays, editing of the information and also obtaining documentation and control punch tapes for manufacturing the products in production.

The operation of the ARM as part of the SAPR and in the autonomous mode is supported by the DOS ARM, the BPO ARM operation systems and the Grif graphical system. In the software there is a monitor test system which monitors the fitness of the technical means of the ARM with automatic recording of the results of the monitoring on the alphanumeric display screen.

In the configuration presented at the exhibition the ARM solves standard problems for various branches of industry: the design of printed circuits with increased composition density; the development of programs and output of control punch tapes for machine tools with digital program control; the design of mechanical parts of simple shape; the output of text and graphical documents and other problems not requiring large volumes of computations.

The problems of designing digital and analog circuits, microwave devices, microassemblies, machine building parts of simple shape and also pressure molds and stamps are solved in the SAPR based on the integrated computer system, small computer system and ARM complexes.

The solution of the enumerated problems is insured by applied programs which are an accessory of the problem-oriented SAPR.

The operating efficiency of the ARM and the improvement of the efficiency of the functioning of the SAPR are achieved as a result of active graphical interaction of the user with the program and the computers; reduction of

the solution time as a result of operative representation of intermediate and final design results; the possibilities of investigation in a short period of time of several versions of the structural designs or circuitry of the product before making the final decision; the possibility of the creation and use of the data bank of the standard designs of ARM and SAPR.

The application of ARM permits acceleration of the process of designing the printed circuits by 2.6 times, the control programs for the digital program control by 3.3 times, the path type processor by 3 times, and the preparation of data for the SAPR by 3-5 times.

The graphical complex of the small computer system provides for effective solution of the problems of machine graphics as a result of active interaction of the user with the computer. The complex is made up of the SM-4 universal computer with the ready-access memory of no less than 32K words and an external magnetic disc memory and EPG-SM graphical display with a light pencil and alphanumeric and functional keyboards.

The architecture of the graphical complex permits various versions of its execution: autonomous, as the basic graphical nucleus of more powerful complexes, as the graphical terminal of the basic computer in the hierarchical SAPR. The "Obshchaya shina" [common bus] universal interface permits easy buildup of the complex to configurations determined by the areas of application.

In the demonstrated configuration the graphical complex of the small computer system can be used when preparing programs for machine tools with digital program control; architectural and construction composition; engineering and design and calculations in construction, machine building, and so on; simulation of transport problems; electronic simulation, and so on.

Effectiveness of the graphical complex of the small computer system is insured by active graphical interaction of the user with the program; the reduction of the theoretical decision-making time; acceleration of the development of the sketches; reduction of the time and improvement of the quality for preparation of production; the possibility of using the standard solution data bank for operation in the hierarchical SAPR.

The operation of the complexes is supported by the DOS ARM and the FOBOS operation systems.

The problems of preparing programs for machine tools with digital program control and the programs of architectural-construction composition have been demonstrated.

The ARM complex for construction planning (ARM-S) is designed for the performance of scientific research work with respect to selection of the configuration and structure of the hardware and software of the SAPR for construction sites, for use as subscriber stations.

The subsystem for automated formation of the design solutions of construction sites based on the integrated computer system is designed to automate the processes of developing the theoretical design solutions. It will permit analysis of the effectiveness of the versions, it will make it possible to determine the values of the technical-economic indexes and control the quality of the investigated versions of the solutions.

In the "Scientific Experiment Automation Systems" subdivision systems were shown which were built on the basis of the following means of the small computer system produced in socialist countries: SM-3, SM-4, IVK-1 to IVK-3 (USSR); RK -- SM-3 (Czechoslovakia); SM 52/20 (Polish People's Republic) -- coupled to the YeS-1045; SM 50/10 (German Democratic Republic) and also systems presented by the Hungarian People's Republic, Czechoslovakia and the USSR based on the integrated computer system: YeS-1011 (Hungarian People's Republic), connected with the YeS-1045 (USSR); ADT 4500 (Czechoslovakia).

The multiterminal system for gathering and processing experimental data for the subdivisions of the scientific research institutes is designed for controlling scientific experimentation and the solution of organizational information problems. It gathers, monitors and processes the information in real time. As a result of the modular structure and the selected methods of organizing the computer processes it insures an increase in efficiency of scientific research and quality of process control.

The system is constructed on the basis of the SM-4 computer, on the IVK-1 and IVK-2 measuring complexes in single-computer and multicomputer complexes with the use of medium and large machines from the integrated computer system at the upper level.

The system offers the user the following basic capabilities: independent parallel execution of problems initiated from several terminals, including remote terminals; multiprogram mode of solution of problems in real time; planning of the starting and control of problems based on priorities; a developed control system for files on different types of information carriers; dynamic distribution of the ready-access memory between the parallel-executed problems; multilevel data input-output control system, including operation with communication lines; generation of the system for various configurations of technical means; access to the resources of the upper level computer from the system terminal and from the level of executed problems; a developed software system, in particular, the translators from high-level languages for writing programs that operate in real time.

The system equipment includes the SM-4P central processor, a 128K-word ready-access memory, the IZOT-1370 magnetic disc storage, the punch tape input-output unit, alphanumeric printer, USVM -- coupling to the YeS-1060, the remote communications adapter.

The composition of the hardware can be expanded by additional magnetic disc memories -- up to 4; and by terminals, the number of which is determined by the computer memory size.

The system was developed on the basis of the real-time operation system.

The measuring complex shown at the exhibition for studies in the area of reflex therapy permits observation of the dynamics of the electrical resistance of the skin of up to 300 points of the organism and generation of recommendations with respect to treatment (skin resistance of different parts of the human body is an informative diagnostic index in reflex therapy).

A simplified version of the measurements with respect to 24 points on distal sections of the hands and feet was demonstrated.

The Mayak-1 measuring computer is a component part of the multimachine automatic complex developed by the LIYaF Institute imeni B. P. Konstantinov of the USSR Academy of Sciences. It consists of the IVK-1 complex and the CAMAC crate with specialized modules oriented to application with semiconductor detectors of nuclear radiation.

The Mayak-1 is a set of software and hardware permitting insurance of multichannel amplitude analysis of signals coming from the nuclear radiation detectors. The basic area of application is problems of experimental low and medium energy physics.

The station includes the SM-3 computer with base complex: the CAMAC functional modules from the IVK-1; a series of specialized CAMAC functional modules; data representation means (a raster display).

The set of modules shown at the exhibition provides for amplification and formation of the signals of semiconductor nuclear radiation detectors, amplitude to code conversion, stabilization of the characteristics of the measuring channel, pulse discrimination, the organization of multiparametric measurements and also representation of graphical and text information.

The automated system for studying the chemical-biological subjects constructed on the basis of SM-1 to SM-3 by the method of electron paramagnetic resonance which has become widespread in many areas was demonstrated: it is used in biology and chemistry, for the determination of the degree of pollution of the air, soil and water with production waste, in agriculture, and so on.

The solution of the mentioned problems without using a computer either has low efficiency or is impossible. The exhibited system increases the loading of the basic equipment by 3 to 4 times; the experimental accuracy by 30 to 40 times; the processing rate by approximately 400 times. The main

thing is that application of the system greatly increases the information returned from the experiment and relieves the researcher of routine work.

The IVK-8 high-precision measuring computer shown in this section is designed for commutation, digital measurement and recording of DC electrical signals, program gathering, storage and processing of the measuring data, output of control inputs, and it can be used in the scientific research automation systems. The complex includes a program calibrator -- source of standard signals -- permitting periodic automatic metrologic certification of 100 measuring channels, insuring maintenance of accuracy of measurement of the input signals in the given range (within the limits of 0.1%).

Along with the achievements in the field of development, production and application of computer engineering means, an effective international complex service system for the computer means (SKO SVT) was shown at the exhibition in the "Technical Servicing" division. The organizations and enterprises of the USSR, Czechoslovakia, the Hungarian People's Republic, Polish People's Republic, German Democratic Republic, Romania, the Republic of Cuba and the People's Republic of Bulgaria participated in this work.

At the present time the SKO SVT are performing the following types of operations with respect to the computer engineering means: introduction of them into operation, guaranteed repairs, technical servicing, delivery, introduction into operation and tracing of the program means, consultation servicing of the users, centralized training of their personnel.

In the USSR the introduction of the hardware, the delivery, introduction into operation and tracing of the software for the integrated system of computers are being realized by the service organizations. Forty percent of the means of the integrated computer system have been converted to centralized servicing. A network of training centers has been set up for the training and advanced training of specialists-users of the integrated system of computers permitting complete satisfaction of the demands for specialist training at the present time.

A list of guidance normative documents and sets of documents defining the technological process of the SKO SVT with respect to services of all types, training documents and organizational structure of the regional service center were demonstrated at the exhibition.

A full-scale fragment of the training classroom was shown at the exhibition with the necessary instruments and equipment: screens, videotape recorders, displays and trainers (USSR, German Democratic Republic, Hungarian People's Republic, Romania, Polish People's Republic).

The central dispatch service of the SKO SVT in the German Democratic Republic realizing the coupling of the main dispatcher of the Robotron Company to the NOTO of the member countries of the Agreement for Cooperation in the Area of Development of Production and Application of Computer

Engineering Means and controlling of the introduction into operation and technical condition of computers produced by the German Democratic Republic in all countries was shown.

Documentation for the standard modules for arrangement of the hardware, models of computer centers and full-scale models of the interior of a computer center were presented.

Operating models of benches for monitoring and repairing the standard replaceable elements, sets of tools and auxiliary equipment (cabinets for storing magnetic tapes and magnetic discs, parts, and so on) and also the portable technical repair workshop were shown.

The past exhibition demonstrated the serious achievements of the member countries of the Agreement for the Development, Production and Application of Computer Engineering Means. The exhibition was visited by more than 100,000 socialists from various countries.

[0558-10845]

10845
CSO: 8144/0558

USSR UDC 681.322.06

AUTOMATED DESIGN OF THE LOGIC LEVEL IN THE 'ASTRA' DATA BANK

Moscow PROGRAMMNOYE OBESPECHENIYE BANKOV DANNYKH [Programmatic Software for Data Banks, Proceedings of the All-Union Seminar] in Russian 1979 pp 66-70

GONIKHIN, O. D.

[From REFERATIVNYY ZHURNAL: AVTOMATIKA TELEMEKHANIKA I VYCHISLITEL'NAYA TEKHNIKA No 11, Nov 79 Abstract No 11B108 by V. A. Mzhel'skaya]

[Text] Problems are considered which relate to automation of the design of data systems for building data banks, particularly requirements which users impose on a data system and requirements associated with special features of building a data bank. The requirement that operation with the system be possible in a high-level language, especially important to users who are not programmers, has been met in the construction of models with an abstract level of data presentation. Other requirements mentioned include efficient operation (minimum time of system response to an interrogation, efficient use of the memory), possibility of changing the informational model of an object, and elimination of anomalies during data manipulation. Problems in automating the design of the logic level for control of a data bank are illustrated in the development of a data bank with a dynamic structure ("Astra"). This system uses a dynamic model as the abstract level of presentation, while the logic level and the physical level are realized in the form of a basal system (systems IMS/2, IDS, IDMS and other can serve as such). The logic level consists of two parts: a logic structure of the data base and access modules, the former constituting a description of relations between data in the language of the basal data system. The algorithm of design of a logic structure is described in detail, its steps being: normalization of the dynamic model, construction of a quasi-optimum structure and interpretation in the basal system. A procedure for the design of access modules is also shown.
[179-2415]

2415
CSO: 1863

Publications

ABSTRACTS FROM THE JOURNAL "AVTOMATIKA I VYCHISLITEL'NAYA TEKHNIKA"

Riga AVTOMATIKA I VYCHISLITEL'NAYA TEKHNIKA in Russian No 6, 1979, pp 91-93

UDC 681.324

EMULATION OF MULTIPLEXER TRANSMISSION OF DATA ON PROGRAMMABLE LOGICAL MATRICES

[Abstract of article by Yakubaytis, E. A., Lemberskiy, I. G. and Podkorytov, M. P., pp 1-10]

Considers the optimal synthesis of an emulator of multiplexer transmission of data on programmable logical matrices. To realize the algorithm of work, the emulator uses methods of logical synthesis known from the theory of automata. The synthesis of one of the commands performed by the emulator is cited as an example. It is noted that the introduction of formal methods of synthesis makes possible substantive optimization of the structures obtained. Two tables, 11 illust., bibl., 3 titles.

UDC 51.62.50

A GENERALIZED APPROACH TO THE MINIMIZATION OF BOOLEAN FUNCTIONS

[Abstract of an article by Shvartsman, M. I., pp 11-14]

Proposes an approach to the minimization of random systems of Boolean functions, which is a generalization of algorithms based on the method of competitive intervals. In this approach the criterion of minimization is the obtaining of the minimum number of different conjunctions. The algorithms can be used in the synthesis of circuits in programmable logical matrices. Results of experiments and statistical evaluations are given. Bibl., 6 titles.

UDC 517.987

A SPECTRAL METHOD OF RECOGNIZING THE SYMMETRY AND MONOTONY OF BOOLEAN FUNCTIONS

[Abstract of an article by V. P. Markova, pp 15-19]

In this paper, using the apparatus of harmonic analysis on finite Abelian groups, the author obtained the necessary and sufficient conditions for symmetry and monotony of Boolean functions. On this basis algorithms for recognizing symmetry and monotony of such functions were constructed. Bibl., 7 titles.

UDC 519.718

FINDING THE MINIMAL DIAGNOSTIC TEST BY THE METHOD OF DECOMPOSITION OF THE OBJECT TO BE DIAGNOSED

[Abstract of an article by V. I. Levin, pp 20-26]

Examines the problem of finding the minimal set of elementary checks $D^{\gamma(\text{lambda})}$ to reveal all the faults in an object. The object is given an an (M,R)-matrix of checks D = ||dij||, where dij = 1 signifies the discovery of the jth fault by means of the ith check, while dij = 0 signifies the failure to do so. An expansion of D^{γ} is obtained for a randomly selected kth row d_k: $D^{\gamma} = (d_k + D^{\gamma}_{k,\ V_k})\ D^{\gamma}_{k}$, --. Here $D^{\gamma}_{k,}$ --is the minimal test for the object, obtained from the initial object by the elimination of the kth check Π_k from those which are permissable; $D^{\gamma}_{k,\ V_k}$ is the minimal test for the object from which the set of V_k faults disclosed by check Π_k is also excluded; γ is the min. A sequential application of this expansion reduces the initial problem to an analogous problem for the object with the matrix D which has small dimensions. An evaluation of the complexity of the solution to the problem depends on its dimensions M and R and parameters of expansion is obtained. Bibl., 2 titles.

UDC 681.327.2:681.326.74.06

TEST CONTROL OF SEMICONDUCTOR MEMORIES

[Abstract of an article by Gavrilov, A. A. and Gavrilov, V. A., pp 27-30]

A method of organizing test sequences for memories with random sampling is given; several effective tests for the functional and dynamic control of BISOZU (large-scale integrated microcircuits internal storage) semi-conductors are proposed. Three illust., bibl., 11 titles.

UDC 681.326.6:62-192

A DETERMINATION OF THE OPTIMAL AMOUNT AND PERIODICITY OF TWO KINDS OF MAINTENANCE

[Abstract of an article by Burlakov, Ye. A. and Staroselets, V. G., pp 31-34]

Examines the problem of determining the optimal amount and periodicity of full and partial control of a system. The solution to the problem is obtained by the method of dynamic programming. An example of solution is given. Two tables, bibl., 6 titles.

UDC 62.506

A STATISTICAL METHOD OF EVALUATING THE OPTIMAL VALUE IN THE APPROXIMATE SOLUTION OF PROBLEMS IN INTEGER-VALUED LINEAR PROGRAMMING

[Abstract of an article by Radashevich, Yu. B., Sidorov, I. M., pp 37-43]

Discusses a statistical method of evaluating the values of an exact optimum in the approximate solution of problems in integer-valued linear programming, based on the features of extremal statistics. A calculation procedure and the results of experiments for problems having different dimensions are given. The potential for using the method in applied problems, solved by means of various approximate methods, is discussed. Three tables, 4 illus., bibl., 6 titles.

UDC 519.283

ON THE ADAPTATION OF LPR (decision makers) TO THE STRUCTURE OF CONSTRAINTS IN AN INTERACTIVE SYSTEM OF SOLUTION TO EXTREME PROBLEMS OF PARAMETRIC SYNTHESIS

[Abstract of an article by Bordetskiy, A. B., pp 44-50]

Examines the possibility of constructing an algorithm of adaptation of LPR's (decision makers) to variation in constraints during a LPR-computer dialogue on the posing and solution to a set of conditional-extremal problems in the synthesis of parameters of a technological system, characterized by the potential emptiness of the acceptable region and non-equivalence of the constraints in importance. The algorithm is based on an imprecise conception of bilateral inequalities. Examples are considered. Two illust., bibl., 6 titles.

UDC 681.324

ASYMPTOTICALLY OPTIMAL DYNAMIC PRIORITIES IN THE CASE OF RECURRENT INCOMING FLOWS

[Abstract of an article by Preger, M. L. and Terpugov, A. F., pp 51-58]

Into one service device there are two recurrent flows of demands with a function of distributions of intervals $G_\nu(s)$ (ν=1,2) with intensities $\lambda_\nu = 1/\int_0^\infty (1-G_\nu(s))ds$, which stand in separate queues. Service is also assumed to be recurrent as a function of distribution of time of service $F_\nu(z)$ and intensity $\mu_\nu = 1/\int_0^\infty (1-F_\nu(z))dz$. The loss function is the form $L = MF(i,j) + C \cdot f$, where i,j are the lengths of the queues, M is an average of the final distribution of probabilities, f is the mean frequency of shift from service of one type of demand to the other. When the service device is freed it begins with probability $S_\nu(i,j)$ service in response to demand of type I (ν=type of demand, which is being serviced). It is shown that with $\frac{\lambda_1}{\mu_1} + \frac{\lambda_2}{\mu_2} \uparrow 1$ the final distribution is concentrated in the region $\delta_1(i,j) = 1, \delta_2(i,j) = 0$. The boundaries of this region, minimizing L, can be obtained from the equation $\frac{1}{\xi_1 - \xi_2}\left[\int_{\xi_2}^{\xi_1} F(\mu_1 x, \mu_2 (z-x))dx + 2C\frac{\lambda_1\lambda_2}{\mu_1\mu_2}\right] \to \min_{0 \leq \xi_2 \leq \xi_1 \leq z}$ and has the parametric representation $i_s = \mu_1 \xi_s(z)$, $j_s = \mu_2(z-\xi_s(z))$, s = 1, 2. Bibl., 5 titles.

UDC 681.142.2

JOB CONTROL IN A TIME-SHARED COMPUTER

[Abstract of article by Maksimenkov, A. V., pp 59-66]

The algorithm for running jobs in a time-shared computer system is discussed. The algorithm follows the assignment of resources to users and thus makes possible the running of jobs with speed proportional to their relative priorities. The algorithm for running jobs, used in the planning system KROS (expansion unknown) for the unified system computer, makes possible an increase in the productivity of the system (averaging 28%) in comparison to the variant where jobs are processed under the control of the OS-4.0 operating system. Bibl., 5 titles.

UDC 681.325.5

A STRUCTURAL METHOD FOR FAST SOLUTION OF A SYSTEM OF ALGEBRAIC EQUATIONS WITH A TRIDIAGONAL MATRIX

[Abstract of an article by Zhabin, V. I., Korneychuk, V. I., Tarasenko, V. P., and Shcherbina, A. A., pp-73-80]

Proposes a structural means of solving systems of algebraic equations with a tridiagonal matrix by the method of "run-throughs," based on the use of

several operational blocks of a quasi-parallel type, performing the computation on a congruent schedule. Computation algorithms for the run coefficients and the unknown in the quasi-parallel operational blocks are given. It is demonstrated that the proposed method makes it possible to decrease the time of solution in comparison with other methods being used, even when matrix operation of the blocks of a parallel type are used in the latter case. Two tables, 2 illust., bibl., 6 titles.

[166-9285]

9285
CSO:1863

ABSTRACTS FROM THE JOURNAL "PROGRAMMING"

Moscow PROGRAMMIROVANIYE in Russian No 5, 6, 1979 pp 110-112

[Excerpts]

UDC 681.3.06

STANDARDIZATION OF MEMORY IN THE TECHNOLOGY OF STRUCTURAL PROGRAMMING

[Abstract of Article by Tseytlin, G. Ye. and Yushchenko, Ye. L.]

The article considers a unified conceptual basis for the structuring of data, programs and memory. A generalized structure of memory is given and a formal apparatus for the representation of structured parallel programs for standardized memory is introduced. Aspects of this approach are examined. Bibliography, 13 titles.

UDC 681.142

A MODEL OF A VIRTUAL MACHINE

[Abstract of an article by Rau, O. I.]

A machine-independent form of representing features in program generators is proposed, based on a trilevel model. This model serves as a basis for the creation of universal methods of arranging memory in special purpose computers and of optimizing object programs for a wide range of computers.
The author expresses gratitude to L. N. Verkholetova who did much work on the representation, using the proposed method, of the characteristics of the BESM-6, Unified System and other computers and also to M. R. Shura-Bura and E. Z. Lyubinskiy for their comment on this work and to N. A. Krinitskiy for useful advice. Two figs, Bibl., 5 titles.

UDC 681.142

SYNTACTICALLY CONTROLLED PROGRAM CONSTRUCTION

[Abstract of an article by Zhogolev, Ye. A.]

An approach to the construction of programs based on storage in the computer's memory of algorithmic information in the form of fragments of syntactical trees is set forth. One fig., bibl., 4 titles.

UDC 681.142.2.378.1

SYNTACTIC ANALYSIS OF ANSWERS DURING COMPUTER TEACHING OF PROGRAMMING LANGUAGES

[Abstract of article by Bratchikov, I. L. and Grafeyeva, N. G.]

A method of syntactic analysis of answers to control questions during computer instruction in programming languages is discussed. This method permits the identification and correction of syntax errors made in the answers. Characteristics of the grammar used to analyze the students' answers are also considered. Bibl., 8 titles.

UDC 681.3.06

USE OF THE ALGORITHMIC LANGUAGE PL/1 FOR THE DEVELOPMENT OF FORTRAN DATA SETS

[Abstract of an article by A. S. Ileyko, A. S.]

Methods for developing sets of FORTRAN data using a subset of the PL/1 algorithmic language, realized in a DOS (disk operating system) and OS (operating system) of a computer is described.

UDC 681.3.06

ON ONE MEANS OF CONSTRUCTING AN APPLIED LEVEL OF PROGRAMMING FOR A COMPUTER NET

[Abstract of an article by Ilyushin, A. I. and Shtarkman, Vs. S.]

The highest level of programming for a net (applied level in the ISO [1] model) is discussed. The traditional approach to the creation of particular protocols for work with each applied subsystem is criticized. An approach to the relationships among a processer and subsystem is proposed which would allow a bilateral "transparency" of the net when the two are removed from each other and would be effective when they are not. Five fig., bibl., 3 titles.

UDC 681.3.068

ON AN APPROACH TO THE GENERATION OF SOURCE PROGRAMS IN CURRENT PROGRAM PACKAGES ON THE UNIFIED SYSTEM COMPUTER

[Abstract of an article by Mikhaylyuk, V. A.]

Issues in the construction of a program generator are discussed. Its use in the place of a loading executive permits the obtaining of a program solution to the problem in a high level language (Fortran, PL/1)--a source program. An algorithm for the operation of a generator of Fortran program, realized in the assembly language of the Unified System computer of the operating system is described. One fig., bibl., 8 titles.

UDC 681.32.06

THE SYNTHESIS OF A LOGICAL SCHEMA OF THE RELATIONAL BASIS OF DATA

[Abstract of an article by Neklyudova, Ye. A. and Tsalenko, M. Sh.]

The article constructs an algorithm for reducing the relations in a data base to the third normal form. Bibl., 9 titles.

UDC 62-50.001.57

THE USE OF CONTROL SEQUENCES FOR FORMALIZED DESCRIPTIONS OF SYSTEMS IN THE CONSTRUCTION OF SIMULATION MODELS

[Abstract of an article by Pranevichyus, G. I.]

Gives a method for the mathematical description of systems during the construction of simulation models, in which the functioning of the system is determined by the controlling random number sequences, and also by algorithms, describing the control of the system by such sequences. Bibl., 8 titles.

UDC 681.326.7

ON THE EVALUATION OF THE RELIABILITY OF THE RESULTS OF THE SOLUTION OF A PROGRAM USING A GIVEN METHOD OF CONTROL AND CORRECTION OF COMPUTATIONS

[Abstract of an article by Novikov, Ye. S. and Khemagurov, Ya. A.]

Probability formulas for the evaluation of the reliability of the information output by a digital computer, for the degree of reliability increase attributable to the use of methods of control, related correction and expenditure are discussed. One fig., bibl., 6 titles.

UDC 681.3.06

THE ANALYSIS OF THE PRODUCTIVITY OF A MULTIPROGRAM COMPUTER SYSTEM, USING BATCH MODE ON THE BASIS OF MEAN DYNAMICS

[Abstract of an article by Garger, V. I. and Kagan, B. M.]

An approximate analytic model of a computer system (VS) using the method of dynamics of means is worked out. An example of the application of the model to a particular VS structure is given. Two structures of the functioning of the VS which differ in the ways the peripheral equipment is connected to the channels are considered and the application of the model in the solution of a problem in the selection of a VS configuration which is rational from the point of view of turnaround capacity is demonstrated. Bibl., 8 titles.

UDC 681.145.2

THE GENERATION OF A PROGRAM FOR PRINTING THE HEADING ON A DOCUMENT BY DESCRIBING THE STRUCTURE OF THE HEADING

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

Describes a language for the structural description of the heading of a document (STROSh), the use of which leads to simplification of programmed printing of the headings of documents. Realized on the OSES, (Unified System Operating System) the computer translates the STROSh into PL/1. A trace of the compiler's work is given. Two figs., bibl., 2 titles.

UDC 681.3.06

A SYSTEM OF OPERATIVE EDITING AND DEBUGGING OF PROGRAMS

[Abstract of an article by Krotov, V. I. and Filimonov, M. B.]

The realization of a system for collective use of an interactive type with a remote batch processing mode is described. It is intended for users debugging programs written in languages of a high level of the operational system DOS ES (Unified System Disk Operating System). Bibl., 4 titles.

UDC 681.3.01:007

PRINCIPLES OF THE CONSTRUCTION OF THE SOFTWARE PACKAGE VEKTOR-1V

[Abstract of an article by Gulyanitskiy, L. F.]

Formulates requirements made of the program packages directed to the solution of problems in planning computer construction. The general structure

and input language of the VEKTOR-1V, which is intended for the solution of problems of arrangement of computer modules and is oriented to the use of various types of computer with developed OS's (in particular, BESM-6 and ES computers). Bibl., 3 titles.

[160-9285]

9285
CSO: 1863

UDC 519.68 : 551.5

AUTOMATED PROCESSING OF HYDROMETEOROLOGICAL INFORMATION

Leningrad AVTOMATIZIROVANNAYA OBRABOTKA GIDROMETEOROLOGICHESKOY INFORMATSII (Automated Processing of Hydrometeorological Information) in Russian 1979 pp 2-5, 300-303

[Annotation, table of contents and introduction from book by V. I. Grigor'yev, Gidrometeoizdat]

[Text] The book presents the working principles of modern computers and methods of automated processing and monitoring of operational and non-real-time meteorological, aerological, agrometeorological, oceanographic and hydrological information, as well as data obtained in some specialized observations. Special attention is given to questions regarding the preparation of data for computer processing; various types of data-carriers are examined. The principles of algorithmization and programing methods are presented in sufficient volume to make the basic material understandable. The book is meant to be an educational aid for the course "Automated Processing of Hydrometeorological Information" in hydrometeorological tekhnikums and can also be used by specialists engaged in practical activity in the given area.

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Introduction

The contemporary stage of development of all sectors of the national economy of the country is characterized by wide use of electronic computers. The application of the latest means of computer and organizational technology permits making complex calculations, improving the quality of the documentation, increasing the precision of the indicators contained in it and reducing the numbers of personnel. Automated control systems (ASU) of various levels--systems for the control of technological processes, enterprises, sectors, etc, are being introduced more and more widely. Being the highest organizational form of use of means of computer and organizational technology, ASU process complex data by means of hardware. In the years of the Ninth Five-Year Plan alone over 2300 automated control systems have been introduced and a considerable saving has been obtained through them.

The decisions of the 25th CPSU Congress envisage expansion of the production of means of computer and organizational technology, a further development of automated control systems and computer centers and an increase of their efficiency.

Electronic computers are used most effectively where it is necessary to deal with a large quantity of different information or make complicated and unwieldy calculations. Hydrometeorology is especially indicative in that respect, as both those factors are present here simultaneously. In

fact, hydrometeorologists analyze a large quantity of information about both the current and the past state of the atmosphere of the earth's hydrosphere. At the same time the schemes of calculations in which that information is included are so complex that they practically cannot be solved without using computers. And that is understandable. For hydrometeorology deals with extremely complex natural phenomena and processes. Let us add to that that very often, for example in the compilation of short-range weather forecasts, all the necessary calculations must be made in very short periods.

To solve the problem of rapid and comprehensive processing of the results of hydrometeorological observations a new technology has been created and introduced in the USSR for the collection, transmission and processing of data in a system of hydrometeorological centers of various categories, equipped with modern electronic computers. The creation of the same system of data processing on a global scale is planned within the framework of the World Meteorological Organization in the form of the World Weather Service.

The introduction of new technology for processing data obtained in hydrometeorological observations required making some changes in the program of work of subsections of the USSR State Committee for Hydrometeorology and Environmental Control (Goskomgidromet). Whereas previously the primary processing of information and its preparation for publication were completed on the level of stations and observatories, now that work goes to a large extent to specialized computer centers and is done there by computers. However, such Goskomgidromet units as posts, stations and observatories are responsible for the high-quality preparation of the observed results for computer processing and their timely transmission to computer centers.

At present hydrometeorologists, along with the traditional disciplines of the hydrometeorological profile, must study the principles of computer technology, programing and methods of machine data processing. It is quite obvious that because of the nature of their activity it is necessary for hydrometeorologists to know, for example, not the design or technical servicing of computers, but their purpose, technical operating possibilities and especially methods of preparing observed data for machine processing. Therefore the subject of the course "Automated Processing of Hydrometeorological Information" is study of the principles of computer technology and methods of machine processing of the results of hydrometeorological observations.

This book represents a first attempt to generalize experience in the creation of methods of automated processing of various types of hydrometeorological information, experience accumulated by this time. The content of the course includes a brief presentation of the mathematical principles, principles of effect and the technical possibilities of the main types of computers. Also presented in the book is brief information on means of measurement and registration of hydrometeorological observations, their transmission, monitoring, processing and storage.

The book is intended as an educational aid for students of all specialties of hydrometeorological tekhnikums. Its contents are divided into three sections, the first two of which contain very general principles and assumptions, relating equally to all kinds of hydrometeorological observations. Those two parts are common for students of all specialties. In the third part distinctive features connected with the specific kind of data are noted. The materials of the third part must be studied selectively in accordance with the educational programs for a specific specialty.

The author expresses his deep appreciation to the scientific editor of the book, Candidate in Geographic Sciences D. M. Filippov, who not only carefully analyzed the manuscript during its editing but also made important supplements and changes in Chapter 14 and participated in writing the conclusions. Scientific advice that permitted improving the text of the book were obtained from the editors: Candidate in Technical Sciences A. N. Nogtikov, instructor, Rostov-na-Donu Hydrometeorological Tekhnikum A. V. Triletskaya, R. P. Kucherova and V. N. Chernyakhovskiy. The author thanks Candidate in Technical Sciences N. M. Potiyevskiy, Candidate in Geographic Sciences A. A. Isayev, Candidate in Economic Sciences G. N. Burlak, V. D. Lyubanskaya, instructors of Moscow Hydrometeorological Tekhnikum O. M. Yefimova and A. A. Antonova, who took upon themselves the labor of becoming acquainted with the manuscript and gave a number of valuable suggestions on its content, and also M. Z. Shaymardanov, who participated in the writing of Chapter 6.

[181-2174]

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CSO: 1863

USSR UDC 681.322.068

AUTOMATIC CONSTRUCTION OF PARALLEL PROGRAMS. PARALLELIZATION OF OPERATOR FLOW CHARTS

Novosibirsk VYCHISLITEL'NYY TSENTR SIBIRSKOGO OTDELENIYA AKADEMII NAUK SSSR in Russian preprint No 147, 1979 34 pp

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

[From REFERATIVNYY ZHURNAL: AVTOMATIKA TELEMEKHANIKA I VYCHISLITEL'NAYA TEKHNIKA No 11, Nov 79 Abstract No 11B164]

[Text] Algorithms of parallelization of operator flowcharts are described, including that of flowcharts with procedures. Considered are also problems in evaluating the degree of parallelism, methods of program restructurization and segmentation aiming at improvement of the parallel structure, and finally some methodological concepts.
[179-2415]

2415
CSO: 1863

USSR UDC 681.51:53

CINEMATOGRAPHIC MOLDS: SYNTHESIS OF THE PHASE STRUCTURE AND PERMISSIBLE ERRORS

Novosibirsk INSTITUT AVTOMATIKI I ELEKTROMETRII SIBIRSKOGO OTDELENIYA AKADEMII NAUK SSSR in Russian preprint No 98, 1979 28 pp

LENKOVA, G. A.

[From REFERATIVNYY ZHURNAL: TEKHNICHESKAYA KIBERNETIKA No 11, Nov 79 Abstract No 11.81.822]

[Text] Methods and the principles of synthesizing the phase structure of optical elements of cinematographic molds are examined here. Estimates are made yielding the permissible errors in the topology of the bands and in the shape of the phase profile which will not cause the image quality to worsen and the diffractional efficiency to decrease when a plane monochromatic wave impinges on such an element.
[178-2415]

2415
CSO: 1863

CONTENTS FROM ISSUES OF VOPROSY KIBERNETIKI (ISSUES IN CYBERNETICS)

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Moscow VOPROSY KIBERNETIKI in Russian, No Number, 1979, p 1

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CYBERNETICS IN MILITARY SYSTEMS

Moscow KIBERNETIKA V SISTEMAKH VOYENNOGO NAZNACHENIYA [Cybernetics in Military Systems] in Russian "Voyenizdat," 1979 263 pp

VASIL'YEV, S. K., ZAKHAROV, V. N. and PROKHOROV, YU. F.

[From REFERATIVNYY ZHURNAL: TEKHNICHESKAYA KIBERNETIKA No 11, Nov 79 Abstract No 11.81.1008 K]

[Text] The book covers principles of designing cybernetic systems, methods of evaluating and synthesizing automatic control systems, use of computers for evaluating the characteristics of linear continuous automatic control systems, methods of analyzing and synthesizing discrete automatic control systems, use of computers for analyzing and synthesizing discrete automatic control systems, analysis of nonlinear automatic control systems, optimization of a control system, self-adjustable automatic control systems, use of computers for analyzing the characteristics of nonlinear automatic control systems, analysis of automatic control systems which takes into account interference, methods of determining the optimum system on the basis of probability criteria accounting for interference, recognition and detection of signals, and use of computers for analyzing the characteristics of cybernetic systems with interference.
[178-2415]

2415
CSO: 1863

USSR

EQUIPMENT FOR AUTOMATIC ANALOG COMPUTER SCALE CHAIN

Leningrad USTROYSTVA AVTOMATICHESKOY SMENY MASSHTABOV DLYA AVM in Russian 1978 signed to press 20 Feb 78 pp 2-4, 93-96

[Annotation, preface and table of contents from Leningrad Energiya Press, 1978, 2687 book copies, by Boris Sergeyevich Smirnov and Yefim Iosifovich Badu, 96 pages. Edited by I. V. Antik, G. T. Artamonov, A. I. Bertinov, M. A. Boyarchenkov, A. A. Voronov, L. M. Zaks, V. S. Malov, V. E. Nize, D. A. Pospelov, I. V. Prangishvili, O. V. Slezhanovskiy, F. Ye. Temnikov, M. G. Chilikin and A. S. Shatalov]

[Text] This book studies a promising method for increasing the quality of analog computation--the method of stepwise scale changing. It can be widely used to perform tasks in which the physical variables change over broad limits, for example, tasks related to the dynamics of mechanisms and nuclear reactors, automatic control systems, crystallography, etc. The hardware embodiment of the method consists of structural and schematic diagrams for scale change devices. Using the example of solution of a specific technical problem, the effectiveness is demonstrated of using the method of stepwise scale change.

The book may be useful to engineers, scientific workers involved in problems of electronic modeling, and also university students.

Foreword

Planning of any complex physical object requires that design research work be performed allowing estimation of the dynamic, strength, economical and other indices of the quality of the operation of the object being planned. This work can be performed by electronic computer study of the systems of differential equations describing the behavior of the physical object, using either analog or digital electronic computers.

Existing computer equipment primarily consists of digital computers and analog computers. Computers of both types have both advantages and disadvantages. Among the main advantages of analog computers are: high speed, possibility of solving systems of differential equations in real time or accelerated time, independence of solution time on complexity of problem to be solved, programming ease, visual clarity of the results of solution and convenience of replacement of masses of numbers in problems being solved. Primary disadvantage of analog computers is the low accuracy of machine solutions, limited by the accuracy with which the elements can be manufactured; as the order of the system of equation increases and the number of nonlinear equations in the system grows, the accuracy and stability of the machine solution decrease rapidly.

The following advantages are characteristic for digital computers: high accuracy of computation, complete automation of the solution process, great capabilities for storage of information and its logical processing. Digital computers have relatively low speed; however, the duration of the solution of the problem varies with its complexity and great quantities of time must be expended in creating software. This incomplete list of the specifics of the two types of computers indicates that the advantages and disadvantages of analog and digital computers are complimentary.

Thus, an analog computer can perform its computational process in real time or even accelerated time with comparatively low accuracy, in spite of the great successes which have been achieved in the area of development and manufacture of analog hardware. On the other hand, digital computers can achieve the required degree of accuracy, but their speed is much lower than that of analog computers.

Consequently, the problem of increasing the accuracy of solutions and the problem of increasing the speed of computation are the primary problems which arise in the development or improvement of computer hardware [23].

One attempt to solve these contradictory problems has been the creation of hybrid computers containing both analog and digital computational elements. Usually the analog portion of the hybrid computer has the task of integrating the system of equations or performing other operations requiring high speed, while the digital portion performs operations requiring high accuracy, and also controls the operation of the entire hybrid system.

There are presently two trends in the creation of hybrid systems. According to the first the hybrid system is created as a combination of computer devices consisting of standard analog and digital computers designed for independent operation, interconnected by means of devices which convert information from analog to digital form and vice versa. This trend has been widely used in the practical activity of computer centers attached to various research organizations. Effectiveness of such hybrid systems is usually low, the difficulties involved with the creation of the hybrid software rather great [17]. According to another trend, the analog and digital portions of the hybrid system and the software are created simultaneously in the form of a single, specially planned computer system. An example of a hybrid system of this type is the GVS-100, developed jointly by Soviet and Jugoslavian specialists.

Comprehensive analysis of the capacities of hybrid systems shows that usually hybrid systems, while more accurate than analog computers and faster than digital computers, are not as accurate as digital computers and are not as fast as analog computers. We must recall that the accuracy and speed of hybrid computer systems depend to a great extent on effective division of labor between the analog and digital portions. In many cases in the solution of specific narrowly specialized tasks, hybrid computers containing standard digital and analog computers cope successfully with

this requirement, as for example in the solution of systems of differential equations in partial derivatives.

Thus, the existing principles of organization of analog digital and hybrid computers do not allow radical solution of the problem of increasing both accuracy and speed.

This book studies one possible trend for increasing the accuracy of analog computers by using the method of stepwise change in scale, based on subdivision of the entire range of change of the variables of the differential equations into subranges with subsequent selection of the scale of the variable for each area. Therefore, the values of machine variables in the equations to be solved cannot be lower than a certain limit, which decreases the influence of intrumental error in the computer unit on the total accuracy of machine calculation and provides the required accuracy over the entire range of change of each area.

This method, embodied in special analog-digital hardware, is widely used for the solution of difficult nonlinear systems of differential equations with wide dynamic range of change of variables, the modeling of which by classical methods involves low accuracy and low stability of the solution.

The authors express their great gratitude to Doctor in Technical Sciences, Honored Activist in Science and Technology of the RSFSR, Professor V. B. Smolov for editing the manuscript and for his valuable comments, which help to improve the book.

Comments and suggestions should be sent to: 192041, Leningrad, Marsovo Pole, No. 1, Leningrad Division of "Energiya Press".

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[182-6508]

6508
CSO: 1863

EXCERPTS ON AUTOMATION AND REMOTE CONTROL EQUIPMENT FROM THE JOURNAL "AVTOMATIKA I TELEMEKHANIKA"

Moscow AVTOMATIKA I TELEMEKHANIKA in Russian No 12, Dec 1979 pp 80, 104, 159, 167, 173-182

[Excerpts]

UDC 65.012.122

INVESTIGATION OF A MULTICHANNEL CLOSED-LOOP CYCLIC SYSTEM FOR HIGH-VOLUME SERVICE

[Excerpt from article by Ye. A. Saksonov]

Given are the results of a study on a multichannel closed-loop cyclic system for high-volume service with a cyclic channel sampling sequence which makes possible determination of basic characteristics of the system such as service message hold time and equipment load. The results may be used in computer-aided analysis and design of similar systems.

UDC 62-506.29

PARAMETRIC OPTIMIZATION OF MOTION EQUATIONS FOR COMPOSITE SYSTEMS AND ADAPTIVE CONTROL ALGORITHMS

[Excerpt from article by A. S. Kulinich and G. D. Penev]

A wide range of manipulator robots is studied. Algorithms are proposed for adaptive control of any robot of the investigated class. These algorithms are based on the use of optimal parametric representation of manipulator motion equations and the elimination of control errors in time as well as specified accuracy of the control object's programmed motion during its entire functioning time.

UDC 62-504.45

DESIGN OF TOTALLY SELF-CHECKING HYBRID DEVICES USING POLYNOMIAL FORMS

[Excerpt from article by A. D. Gorozhin and K. S. Kraynov]

The problem of designing totally self-checking hybrid devices in polynomial form is considered. Conditions are given for interfaced implementation of functions in such hybrid devices.

UDC 656:65.012.122

HEURISTIC ALGORITHM FOR SOLVING GENERALIZED TRANSPORTATION PROBLEMS

[Excerpt from article by I. I. Melamed and Yu. M. Plotinskiy]

The problem of determining routes for delivery vehicles transporting small freight consignments between several points is considered. Each point may both ship and receive freight consignments. The problem is reduced to a classic transportation problem with added limitations. An integer formulation of the problem is given along with an effective heuristic algorithm for its solution.

UDC 53.072:51:681.3:621.394.74

MATHEMATICAL MODEL FOR DETERMINING THE COMPOSITION OF HARDWARE FOR COMPUTER NETWORK COMMUNICATION

[Excerpts from article by N. N. Kovalenko and P. A. Petrenko]

Algorithms are proposed for optimizing the composition of data transmission hardware for computer networks and for their optimal configuration at data collection points with allowance made for the rate of data transmission from these points to concentration nodes with minimum equipment and channel rental costs.

Introduction

A sector ASU [automated control system] is known to be composed of a considerable number of discrete territorial computer centers (VTs's) which are the technical base of this system. The technical base of the system also includes data transmission equipment (user terminals), data concentration and multiplexer units, and telephone and telegraph communication channels. As a rule, sector ASU's are classified according to administrative principles and geographical location in different regions, each of which is composed of a high-capacity VTs with branched collection and data transmission networks. A region usually represents a radially hierarchical structure, one of which is presented in figure 1.

Let us consider the given network structure. A multivariable problem then arises in choosing the optimal composition for the hardware and its configuration in data centers and in determining the optimal data transmission rates in communication networks for the least cost.

We will concentrate data at the nodes by means of a remote data transmission multiplexer (UMPD). It should be mentioned that the choice of optimal rates for data transmission from data centers to concentration nodes is the main link in solving this problem for each concentration node. If this problem is solved, then the problem of selecting the type of hardware can be solved since there is a definite correlation between the data transmission rate and the type of hardware, that is a certain type of hardware or several types of hardware correspond to a certain data transmission rate and vice versa.

6. Example

Let us consider the segment of the network presented in figure 1 for data centers numbered from 1-7.

The source data is presented as table 1.

The hardware types are presented as table 2.

The communication channel output rate of the multiplexer is B = 1200 bit/sec at the concentration node.

The value of the F functional for T is computed as:

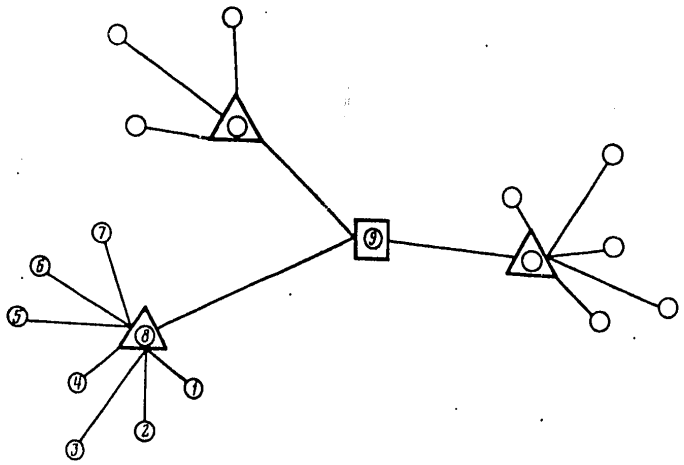

Figure 1: Radial Hierarchical Structure of a Region; 1-7--Data Processing Centers of Concentration Node; 8-9--Computer Centers; ○ --Data Processing Centers of Other Concentration Nodes.

Table 1

Data Center No.	Daily Volume of Transmitted Data in Notation-10^3	Time (min.) for Transmission of Daily Data Volume With Data Transmission Rate (bit/sec)					Communication Channel Rental kop/min
		50	75	100	200	600	
1	36	86	72	60	30	8	5
2	34	81	70	56	28	8	15
3	24	56	48	40	20	5	15
4	10	24	20	16	8	2	5
5	10	24	20	16	8	1	15
6	48	112	98	80	40	11	15
7	24	56	48	40	20	5	15

a) T = 1 year ≈ 300 working days,

b) T = 2 years ≈ 600 working days,

c) T = 10 years ≈ 3000 working days.

The solutions are

a) $F_1^* = \min (5.137x_1 + 4.856x_2 + 4.710x_3 + 4.837x_4 + 10.218x_5)$,

b) $F_2^* = \min (7.274x_1 + 6.712x_2 + 6.420x_3 + 5.674x_4 + 10.436x_5)$,

c) $F_3^* = \min (24.37x_1 + 21.56x_2 + 21.10x_3 + 12.37x_4 + 12.18x_5)$

with the restrictions

$$50x_1 + 75x_2 + 100x_3 + 200x_4 + 600x_5 \leq 1200,$$

$$x_1 + x_2 + x_3 + x_4 + x_5 = 7,\ x_i \geq 0,\ i = 1,\ldots,5.$$

The algorithm for optimizing the composition of hardware for data transmission to a concentration node has the solutions given in table 3.

This is well illustrated in geometric form in figure 3.

The solutions {0,0,7,0,0} will be optimal only in the time segment [0;1,2] ε T, while the solutions {0,0,2,5,0} are optimal, as figure 3 shows, in the time segment T ε (1,2;∞) since the equation for line b_5 does not satisfy (1) and (2). Therefore, the optimal solution {0,0,2,5,0} will be the total optimum.

Thus, if the value of F for T>1 is not considered, it is possible to err in choosing the correct optimal composition of the hardware for data transmission to the concentration node. This happens because we have only loaded the UMPD 58 percent and not completely (see table 3).

Table 2

Type of Equipment	Data Transmission Rate, bit/sec					Cost, thous. rubles
	50	75	100	200	600	
$A_{1,2,3}=A_1=A_2=A_3$	X	X	X			$a_1=a_2=a_3=3$
A_4				X		$a_4 = 4$
A_5					X	$a_5 = 10$

Note: X — Availability of specified APD with appropriate speed.

Table 3

No. p. p.	Solution $\{x_1,x_2,x_3,x_4,x_5\}$	Use Factor for UMPD at Rate (k)	Functional F, thous. rub. F_1 with T_1 = 1 year		F_2 with T_2=2 yr.		F_3 with T_3=10 yr.	
			F_1	F_1^*	F_2	F_2^*	F_3	F_3^*
1	{0,0,7,0,0}	0.58	32.97	32.97	44.94		147.7	
2	{0,0,2,5,0}	1	33.605		41.21		104.05	104.05

We have concluded that the optimal composition of hardware for data transmission to a node will be as follows: two units of $A_{1,2,3}$ type hardware operating at a maximum rate V_3 = 100 bit/sec and five A_4 type hardware units operating at a maximum rate V_4 = 200 bit/sec.

The algorithm for optimal configuration of hardware at data centers produces the following: one $A_{1,2,3}$ type at points 4 and 5 and type A_4 at the remaining five points.

Note that in solving this example by the method of checking all possible variations we would have to consider about 150 of them in order to arrive at the result we obtained using the two algorithms given above.

Conclusion

The approach proposed in the article makes it possible to solve the problem of choosing hardware for data transmission to data processing centers of a network and to concentration nodes. The optimal choice of hardware in concentration nodes should be made by checking and subsequent comparison of several variations whose number equals the number of types of concentration hardware.

The given algorithm makes it possible to minimize costs for network node hardware and for rental of communication channels from terminal data processing centers to concentration nodes. The algorithms are easily understood and, for networks with a small number of nodes, the calculation can be done without using a computer since a few steps are usually sufficient in practice for finding a solution.

The proposed method makes possible optimal selection of hardware for data processing centers of networks with allowance made for physical and mental attrition.

Reliability of the data transmission is taken into account in using the proposed method. When a sectional ASU is designed a data transmission reliability is specified and an APD [data transmission device] with appropriate characteristics is selected accordingly. Thus, the specified reliability is insured by the choice of APD type.

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8945
CSO: 1863

USSR UDC 681.322.068

FORMAT OF 'ENSDF' AND ITS USE IN PROGRAMS WRITTEN IN 'FORTRAN'

Leningrad LENINGRADSKIY INSTITUT YADERNOY FIZIKI in Russian preprint No 477, 1979 25 pp

KABINA, L. P., KONDUROV, I. A. and TYUKAVINA, T. M.

[From REFERATIVNYY ZHURNAL: AVTOMATIKA TELEMEKHANIKA I VYCHISLITEL'NAYA TEKHNIKA No 11, Nov 79 Abstract No 11B143]

[Text] A description is given of an Evaluated Nuclear Structure Data File (ENSDF). Described are also programs for figuring and decoding standard formats of ENSD files recorded in FORTRAN for a BESM-6 computer and Unified System YeS computers.
[179-2415]

2415
CSO: 1863

LOGICAL METHODS OF CHECKING AUTOMATED DEVICES

Riga AVTOMATIKA I VYCHISLITEL'NAYA TEKHNIKA in Russian No 6, 1979, pp. 81-82

[Book review by P. P. Parkhomenko of: A. N. Sklyarevich. Fundamentals of logical methods of checking automated devices. Riga, Zinatne, 1979, 192 pp.]

[Excerpts] The widespread development of digital logical devices, computers and systems has put in the forefront problems of verifying their working order, efficiency and search for defects. In spite of the significant number of publications devoted to logical methods of diagnosis of digital apparatus, the issues raised and the scientific direction taken in this monograph are still urgent. The approach developed in the book differs from the approaches of other researchers in the methods of solving the problems dealt with, and in a number of cases in the way the problems are posed as well. The book expounds a structural operating method of solving the problem of technological diagnosis, which the author has developed, in which the object of analysis is the structural schema of the devices, possible faults are considered to be introduced by individual operators, and the finding and confirmation of results are performed analytically. Instead of a sequential search for each of the possible faults by elementary checks followed by putting them all together, it is proposed to perform an aggregate all at once for a whole class of given faults.

Combinative as well as sequential devices (automatons) of a definite structure are analyzed. An important conclusion of the analysis is the formulation of simple rules for obtaining the verification test of the automated device by means of the "sticking together" of sets of verification tests of the component automated devices. This paves the way for the development of a recursive methodology for setting up tests.

On the whole, the book is a useful contribution to the theory of technological diagnostics of digital devices and can be recommended to those who work in this area or in related ones. The ideas contained in this book also may be used in the solution of other problems in the analysis of digital devices.

[166-9285]

9285
CSO: 1863

USSR UDC 681.325.5

MICROPROCESSORS AND MICROCOMPUTERS

Moscow MIKROPROTSESSORY I MIKRO-EVM [Microprocessors and Microcomputers] in Russian Izd-vo Energiya, 1979 231 pp

PRANCISHVILI, I. V.

[From REFERATIVNYY ZHURNAL: AVTOMATIKA TELEMEKHANIKA I VYCHISLITEL'NAYA TEKHNIKA No 11, Nov 79 Abstract No 11B221 by V. A. Garmash]

[Text] General principles of constructing microprocessors and microprocessor systems are outlined here. The discussion covers basic characteristics and special features of microprocessor, microcontroller and microcomputer software. Principles of microprocessor and microcomputer control are also outlined, along with method of their implementation. Various means of expanding the functional capabilities and increasing the computing power of microprocessors are considered. Methods of constructing multimicroprocessor control-computer systems are outlined and their scopes of applicability defined. The book contains the following chapters: special features of microprocessors, principles of microprocessor and microcomputer control and methods of their implementation, when and how does it become worthwhile to use microprocessors, universal microprocessors and microprocessor assemblies with large-scale integration of general-purpose circuits, single-crystal microcomputers and microcontrollers, increasing the productivity and expanding the computing power of general-purpose microprocessor by ganging special-purpose microprocessors and auxiliary microcircuits, lumped and distributed multimicroprocessor control-computer systems, etc.
[179-2415]

2415
CSO: 1863

USSR UDC 658.512.2:681.322.06:001.8

'PITFALL' PROGRAM FOR RESEARCH ON A NATURAL LANGUAGE

Novosibirsk VZAIMODEYSTVE S ELEKTRONNOY VYCHISLITEL'NOY MASHINOY NA YESTESTVENNOM YAZIKE [Interaction with a Computer in a Natural Language] in Russian 1978 pp 48-65

BESTUZHEF, E. and DEKLE, ZH. P.

[From REFERATIVNYY ZHURNAL: TEKHNICHESKAYA KIBERNETIKA No 11, Nov 79 Abstract No 11.81.411 by V. P. Mazurik]

[Text] A description is given of the Interdisciplinary Program for Processing a Natural Language (PITFALL). The purpose of its development was to establish a system of concepts whose adequacy for researched linguistic phenomena would be reliably verifiable. In contrast to conventional classifying operator systems, here a more abstract metalinguistic system of concepts is proposed. On the basis of the developed theory, it is possible to solve problems of search for equivalent statements-paraphrases and for grammatical invariants involved in extraction and transfer of categories. It is shown how traditional linguistic procedures can be combined for the construction of a sufficiently general formal apparatus. Demonstrated is also the interaction between three ingredients of research: language theory, mathematical apparatus and programmatic software. A few examples are brought to illustrate the basic introduction of this concept and the proposed approach. References 18.
[178-2415]

2415
CSO: 1863

USSR UDC 681.51:519.246

PRINCIPLES OF ORGANIZING A MONITOR FOR A COMPLEX OF PROCEDURES INVOLVED IN SIMULATION OF DISCRETE SYSTEMS

Novosobirsk VYCHISLITEL'NYY TSENTR SIBIRSKOGO OTDELENIYA AKADEMII NAUK SSSR in Russian preprint No 163, 1979 44 pp

MITROFANOV, YU. I., IVANOV, A. N. and YAROSLAVTSEV, A. F.

[From REFERATIVNYY ZHURNAL: TEKHNICHESKAYA KIBERNETIKA No 11, Nov 79 Abstract No 11.81.485]

[Text] In the article are outlined the principles of organizing a monitor (system of gathering and processing statistical data) for a complex of procedures involved in simulation of discrete system, which have been written in the ALGOL-60 language, are also shown the algorithms of that data gathering and processing, and is discussed the informational organization of the monitor base.
[178-2415]

2415
CSO: 1863

UDC 007:51:681.3

SPECIALIZED SOFTWARE FOR MANAGEMENT

Moscow SPETSIAL'NOYE MATEMATICHESKOYE OBESPECHENIYE UPRAVLENIYA (Specialized Software for Management) in Russian 1978 signed to press 14 Jul 78 pp 17-28

/Preface and introduction from book by Mikhail Ivanovich Gvardeytsev, Vladimir Petrovich Morozov, and Vladimir Yakovlevich Rozenberg, Izdatel'stvo "Sovetskoye radio," 6,000 copies, 512 pages/

/Text/ Modern science devotes a great deal of attention to the problems of management as a whole and to quantitative methods of substantiating decisions being made in particular.

Tremendous material resources have been created by society. Efficient use of them is largely determined by the quality of management. The means of automation can impart a fundamentally new quality to management. However, hopes for raising the quality of management by introducing automated systems for management have not yet been realized in full measure. The means of automation have not yet become a sufficiently powerful aid to managers at all levels. Many managers do not receive the necessary help from them. Results of work done by automated means are either not received by managers in general, or are received after processing by assistants. The manager uses these results episodically. All this indicates that the potential of automated means for information processing is far from being used in full measure. Moreover, where they could have the greatest effect--in supporting timely and substantiated decision-making at the higher levels of management--they are practically not used.

Such is the situation the authors have encountered in their practical activity.

The basic reasons for this situation are as follows.

First, management in society is a complex creative process. The laws of management are not yet clearly understood and formalized, and this retards the rate of introduction of automated means.

Second, the concept of automated systems for management has been largely identified with electronic computers. In the process, the role of algorithms and programs intended for substantive processing of information to produce quantitatively substantiated proposals for decision-making in the management process has been underestimated.

Consequently, the organization of development of these means needs improvement. The means of substantive processing of information (specialized software) are not developed systematically. Insufficient resources are allocated for their development. The means for substantive processing of information are not being materialized in a form allowing their accumulation, propagation, improvement and efficient use. These means often remain the personal tool of the author or at best the organization that created it and uses it. They are often destroyed without good reason instead of being of benefit to many groups and organizations.

Third, to date there has been no theory of construction of specialized management software and of technology for its development, introduction and use. Electronic computers are developed on an industrial basis. Specialized management software is developed by small non-specialized groups. Developing specialized management software is currently considered an art. To eliminate the noncorrespondence between producing the hardware and the software for automated management systems, /developing specialized management software must become a science./ [boldface]

Society's management systems are characterized by a deep interrelationship of various processes which is manifested in the interdependence of various industrial enterprises and entire sectors, in their links with transportation, etc. The aggregate of means of substantive processing of information must reflect this interrelationship in order to raise the efficiency and soundness of management. Thus, it must be a system which will be developed and changed together with the evolution of the management system.

Although there are many fine books dealing with the various questions of creating the means of automation and with software and information support, until now apparently, there has been no book in which the questions of creating specialized software as an object intimately associated with management, and not with hardware, have been discussed from general positions.

This book is devoted to the theoretical questions of constructing a system of specialized management software.

The first three chapters cover general questions associated with this system, define its place and links to management, science and industry, and formulate the basic requirements for its properties.

Chapters four through seven discuss the basic questions of the technology of creating the individual subsystems of the specialized management software system.

Chapters 8-11 deal with the questions of introducing and using specialized management software facilities, as well as with the basic principles of their maintenance and modification.

Chapters 12 and 13 discuss questions of evaluating the efficiency of the use of the specialized software and the necessity of creating a theoretical base is substantiated.

The last chapter is devoted to questions of evaluation of the current status of the problem of constructing a specialized management software system.

Conclusions are given at the end of each chapter.

The appendix contains a list of some of the unresolved problems that occur during the construction and introduction of a specialized management software system. The authors hope that these problems will attract the attention of specialists.

This book is intended for scientific workers, managers at various ranks and levels, managers directing the development of means of automation, and specialists who develop the means of automation and software.

The book will be useful to new specialists and students interested in the problems of introducing the means of automation into management.

This book is the result of many years of work done by the authors in the area of raising management efficiency based on the means of automation.

The material in the book is based on new ideas and results and has not yet been published anywhere. When the authors used results already known, references to the sources are given in the text.

The book is a result of the joint effort by the authors who bear equal responsibility for its content.

The authors express special appreciation to Fleet Admiral of the Soviet Union S. G. Gorshkov for participation in the formulation of the concept of specialized management software.

The authors are grateful to V. G. Afanas'yev, corresponding member of the USSR Academy of Sciences, and to Professor D. V. Valovoy, doctor of economic sciences, with whom they consulted while writing the book.

The authors condider it their duty to express appreciation for useful advice to academicians V. M. Glushkov, G. I. Marchuk, V. S. Semenikhin, A. N. Shchukin; A. P. Yershov, corresponding member of the USSR Aacademy of Sciences; and to professors N. G. Barinov, V. I. Drakin, A. A. Fedulov and L. I. Gorshkov.

The authors are deeply grateful to P. G. Kuznetsov for help in preparing the manuscript for publication.

Introduction

A child was born into a family. This brought a whole new set of concerns and worries into the home. A crib, carriage and baby clothes had to be acquired. You are anxious to see that your child grows up strong and healthy. You start thinking about where he will go to school. In time comes the concern about where he will live and where he will work. Clearly, the child's health depends on medical services. His education, on the quality of instruction in the school, etc.

If you are wondering how /specialized management software/ /italics/ is related to these concerns and worries, then most likely you are simply surprised. At first glance, there is no clear link between your concerns and some software.

We will try to dissuade you from this.

For the child to receive qualified medical service, the chief physician of the closest polyclinic has to be not only a skilled specialist, but he must also know how to successfully solve the problems of management: to organize rationally the work of personnel, select personnel, take care of equipment, delivery of medicines, etc. For this purpose, the city managers must also solve many problems of management associated with determining the required number of children's polyclinics, hospitals and their locations. For this, they must know how to forecast the growth of the city and its long-term needs. If they err in their decisions, i.e., make an /unsound/ /italics/ decision, then either the supply of medical services will be inadequate, or unwarranted outlays made. Clearly, both situations are bad. In the first case, the child will not receive timely medical aid, and in the second, excess outlays in one place lead to shortages in another, for example, for building kindergartens, schools and apartments. If their decision is not made in time, /inefficiently/ /italics/, then you will not be able to obtain the necessary help at the moment needed.

Your concerns and worries are directly related to the Minister of the Medical Industry. In directing the industry, he must make the decisions which will ensure timely production of medicines in a volume which will meet your needs. It is not difficult to imagine how complicated it is to substantiate and make rational decisions in good time with deep foresight.

Without special explanations, it is clear that your child's welfare depends on many managers.

Now answer this question: Have all your concerns always been resolved without difficulty? Without waiting for your answer, we can confidently say that it would be "no." The physician did not always come promptly,

you had to wait your turn at the polyclinic, there was no immediate opening in the kindergarten, there were difficulties with the apartment, etc.

In the process, you involuntarily identified managers with the results of management in society. Actually, in the example discussed, the successfulness of the solution to all the problems you faced depends on the quality of management. The welfare of each member of society, his living conditions, life-style and rest, his working conditions and success depend on it. Common to the set of heterogeneous processes flowing in society is the dependence of success on the quality of management.

Thus, to the question of how your living conditions could be improved, one could reply that the quality of management has to be improved. This would be the correct conclusion.

Continuing this reasoning and correctly noting that management in society is effected by people, one could conclude that it is sufficient to replace weak managers with more capable ones and then shortcomings would disappear. This would be a completely false conclusion.

The difficulties which we run into have not a subjective, but an objective nature. It is not possible to eliminate them by simply replacing the people responsible for management. The basic reason for the difficulties is the tremendous complication of the objects of management and the sharp increase in the interrelationships between them. The complexity of these interrelationships is such that a manager objectively cannot comprehend and interpret the entire flow of information reaching him, evaluate the situation which has taken shape, and find and make a sound decision. Each concrete decision made by a manager must in full measure correspond to the objective laws of social development. The check for the conformity of a decision being made to these laws must proceed at the rate of flow of the process of management.

Consequently, ways of helping the manager have to be found. As will be evident from subsequent statements, the traditional way of increasing the number of people working in the sphere of management and the number of management agencies has already been exhausted. The only way out is to improve the support given to management and to create the means for raising the efficiency of management.

In recent years, it has become customary to link hopes for increasing management efficiency to the introduction of electronic computers and automated systems for management. They are talked about, they are written about, and only sometimes, as if secondary, is their software mentioned.

In our opinion, such a view is not only incorrect, but even harmful. The inaccuracy lies in the shift of concepts. Software, including specialized, is considered a means with the aid of which machines operate. Perhaps we are exaggerating the situation somewhat, but there is much truth in this evaluation.

In any sphere of activity, each decision is a consequence of the search for the best alternative from the set of those possible. The best alternatives are those which in full measure correspond to the objective laws of social development. Prior to the emergence of electronic computers, scanning the possible alternatives for achieving a final goal, as a rule, was done by man subconsciously, while the decision was a consequence of creative dawning. The best decisions, the correctness of which was confirmed by history, have been made by geniuses who had the capability of intuitive scanning of the set of alternatives for achieving a goal. Recall the discovery by Mendeleyev of the periodic table of elements, Kutuzov's decision at Fili, Titov's ship designs. The increase in the number of interrelationships in society has complicated the process of selecting the rational alternative of the decision, and at the same time, the degree of influence of decisions made in management on the many aspects of human activity has been raised. Therefore, there has emerged the problem of strengthening the capability of each manager for scanning the set of possible alternatives for achieving a goal and selecting the best from it. The emergence of electronic computers has created the prerequisites for solving this problem. However, the machines themselves are not capable of solving this problem. Specialized software has to be created to scan and evaluate the possible alternatives for achieving a goal. Only with its use can one entrust working out and evaluating possible alternatives to the machine, reserving the right to select the decision for man. Such an approach makes it possible to strengthen the intellectual capabilities of man as he makes decisions in the process of management.

Thus, specialized management software, based on the objective laws of social development, must become the basic tool for raising the intellectual capability of a manager. This concept is inexorably linked in the first place to the content of management. For specialized management software, electronic computers are only the means, with the aid of which information is processed, the means for making computations.

The harm of the view on the role of software, which has been formed, lies in the fact that as a consequence, insufficient resources are allocated to create it, the necessary organizational conditions are not established, and the theoretical principles for creating, introducing, using, maintaining and modifying it are developing slowly. Having put electronic computers in the forefront, we tie software directly to them and create the conditions under which all the attention is focused on building these machines. The main resources allocated for management improvement are spent on them. This leads to non-systematic and non-harmonious development of the means for raising management efficiency. Software, considered an adjunct to computers, is developed with delay and on limited scales.

Moreover, in the process, the conditions are inevitably created for software to be destroyed, lost and obliterated when a specific type of machine is replaced. While this may be in order for that portion of the software serving the operation of the equipment and the operation of the machine, it is

impermissible for that portion of the software effecting the substantive processing of information and serving the management process. This portion of the software (specialized software for management) is linked directly to the content of the management process. Without it, it would be impossible to solve the problem of raising the efficiency of management based on means of automation.

Academician A. P. Aleksandrov has pointed out three basic national problems: the program for development of energetics, the program for development of agriculture and the program for making use of computer technology.

The successful accomplishment of the first two programs is impossible without the solution to the problems of the third program, which is aimed at radical improvement in the planning, control and optimization of production. The essential basis of this program is the construction of a system of specialized software in which the objective laws and the theory of management of social development must be reflected in the form of algorithms.

The bases for building a system of specialized software are the mathematical models and algorithms which process status information into management parameters. We are attempting to follow the track by which mathematical models (algorithms) come into practice. Scientists in scientific research institutes complete their work by general problem-solving methods. If they work in cooperation with industry or fulfill specific orders, then the results of their labor can have the form of completed algorithms and programs for electronic computers. Where do all these results go? Without fear of being too badly mistaken, the authors maintain that these results are actually going "nowhere." The stream of scientific results, aimed at improving the quality of management through the introduction of quantitative methods, flows into the "ocean" of general scientific results. A small part of it goes to specific computing centers and automated systems for management, as well as into state and sector stocks of algorithms and programs. A still smaller portion is published in a form affording the possibility of reproduction. Thus, between science and the practice of management, there is a gap which leads to the loss of results of scientific labor.

Let us return to the needs of the manager. The striving to help him to make sound decisions has led to the creation of a number of new theories. Thus, we have seen emerge game theory, operations research, and decision theory, including under the conditions of uncertainty. All these theories and their methods are supposed to serve the manager in substantiating and making a decision. It is believed that a skilled manager should possess all this knowledge. Let us suppose that a manager is really familiar with all these theories and methods.

What benefit can he derive from this?

It is clear that with the help of the general principles of these theories, he will be able to formulate more quickly and more accurately those problems which must be solved to achieve a goal, to assess more deeply the situation which has taken shape and outline a general course of action.

However, this is not enough. He needs daily and continual assistance consisting in quantitative substantiation of the various alternatives of decisions and in the selection of the best from them. For this he should use not general principles of theories, but their specific results and methods. Such results, as a rule, are not ready recipes for action. These results are presented in the form of rules for processing information. A manager cannot implement these rules without enlisting modern means of management support. So that the manager can make use of these rules, they must be materialized in a form allowing automation of the process of information processing. This materialization must occur with regard to the interrelationships of the various objects and systems which interface with each other, and with regard to the possibility of fixation of their current state and history of development.

A system which materializes the rules for information processing in a form permitting automation of their execution is called by us a system of specialized software for management. This system must unite the methods of theory and the experience of the practice of management and present them in a form permitting utilization of the technical means of automation of transmission, reception, storage and processing of information.

The unification of this system with computers and other automation hardware will make it possible to raise management efficiency.

In this book, we wanted to examine the weakest point, in our opinion, in the aggregate of means for raising the efficiency of management--the state of development of the means of substantive processing of information in the process of management. In the book, we have defined the concept of a system of specialized software for management, its role and place in the system of management and in the aggregate of other means of automation of management; we have discussed the fundamental questions of building a system; and we have formulated the conditions for its successful development. Analysis of the evolution of the process of introducing means of automation for management and the experience gained have shown that the problems of substantive processing of information are the most difficult in raising the efficiency of management. In connection with this, the need arose for a theory of building a system of specialized software for management.

Specialized software for management, we are deeply convinced, is a new area of science and practice that must be rapidly developed in the coming decades. This is a field in which there are more blank spaces than derived results, and in which there are many problems requiring profound theoretical research. The development of this area will proceed both along the line of theory as well as the line of practice. The practical needs for raising management efficiency are so great that they will inevitably have a great effect on the development of theory. It is a question of creating a materialized collective "automated brain," which will absorb all the achievements of science and the practice of management, will be developed, improved, taught, and will become the basic amplifier of the intellectual capacity of mankind.

In conclusion, here is some advice for readers in various occupations.

For managers responsible for the distribution of resources and organization of work in the area of improving management, it is sufficient to become familiar with the material in chapters 1-3, 12-14 and paragraphs 4.1 and 4.2. There they will find the statement of the basic aims for creating a system of specialized software, a description of the areas of its application, a statement of the basic requirements for the properties of the system, and organizational suggestions associated with the need for industrial development of specialized software.

Managers who intend to make use of automated means to raise management efficiency will find it useful to also familiarize themselves with the material in chapters 4, 8-10. There they will find a presentation of the questions of organization of the development of specialized software for management for autonomous subsystems, its introduction and maintenance; information on the conditions of development of specialized software for management and ways to assess its efficiency.

We recommend that scientific workers, managers heading organizations developing means for raising management efficiency, specialists in the field of automation of management, as well as students and new specialists looking for a place to apply their creative powers read through all the material.

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UDC 681.51:519.816

THEORY OF OPTIMUM SOLUTIONS

Kiev TEORIYA OPTIMAL'NYKH RESHENIY in Russian Izd-vo Instituta Kibernetiki 1979 106 pp

NEKHANOV, E. I. (editor)

[From REFERATIVNYY ZHURNAL: TEKHNICHESKAYA KIBERNETIKA No 11, Nov 79 Abstract No 11.81.427K by T. M. Kuznetsova]

[Text] The book deals with several problems in the theory of optimum solutions. Included in the analysis are the problem of group pursuit in linear differential games and the problem of many traveling salesmen, the first straight method of L. S. Pontryagin for the pursuit problem, the truncated method with linear transformations of space, a procedure for reducing the algorithms of unconditional minimization, the dual method of solving problems in convex programming with linear constraints, and the method of variable directions in the nonlinear theory of evasion. The study covers also problems of hardware standardization and layout, use of sequential algorithms of optimization for correcting a plan or a curvilinear road profile. Developed is also an approach to the construction of a model of cloth impregnation with an inert gas and models of optimum blood stream distribution between tissues in a human organism.
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