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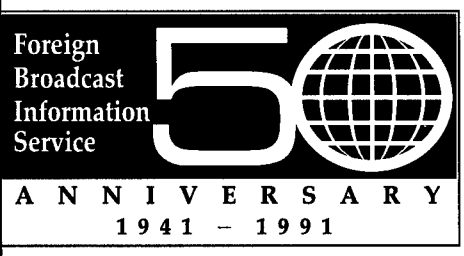

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USSR: Computers

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Robust Algorithm for Demarcating the Boundaries of Weakly Contrasted Regions of an Image

917G0049A Moscow AVTOMETRIYA in Russian No 4, Aug 90 (manuscript received 2 Feb 90) pp 31-37

[Article by A. A. Belokurov and V. S. Blyum, Leningrad]

UDC 621.396.96:391.2

[Abstract] One of the most important requirements when creating automatic signal and image processors is that the algorithms used remain stable when the observation conditions change. The stability of algorithms in the face of an arbitrary slow change in background intensity is achieved by using the methods of similarity and unbiasedness, the principle of invariance, and adaptation. Such algorithms are, however, generally based on a rather simple approximate statistical model. Even small deviations of the real distribution law governing a distributed signal from the model of that law result in a significant reduction in the algorithms' quality indicators. Stability in the face of variations in the distribution law (i.e., robustness) is usually achieved using nonparametric statistics methods. This often greatly complicates the structure of the decision rule and thus results in losses in efficiency that do not always turn out to be justified. The present article examines an approach to synthesizing robust algorithms that makes it possible to find a compromise solution. The approach is based on the possibility of expanding an idealized (basic) statistical model of observations within the framework of a parametric family of distributions with an allowance for the deviations that are expected under real conditions. In that case, the robust properties of the algorithm for a specified family are achieved with invariance to a priori unknown parameters of the expansions of the model. The authors develop a minimax robust algorithm for detecting the boundaries of weakly contrasted areas of a radar image. The resultant algorithm is invariant to variations in image intensity, guarantees a specified probability of false detection given a change in the statistical characteristics of the radar image over a broad range without adjusting the threshold, and possesses satisfactory power indicators. The algorithm's fixed structure and simplicity make it suitable for use in automated radar image processors and for processors of analogous-type two-dimensional fields. Figures 2; references 10: 2 Russian, 8 Western.

GAMMA-7.1 Display Station

917G0049B Moscow AVTOMETRIYA in Russian No 4, Aug 90 (manuscript received 16 Jan 90) pp 37-39

[Article by A. A. Buchnev, V. F. Minin, and V. G. Sizykh, Novosibirsk]

UDC 681.327.23

[Abstract] The GAMMA-7.1 display station is intended for use in computer-aided design systems and in performing such tasks as image processing, mathematical modeling, and controlling manufacturing processes. It has a screen resolution of 1024 x 768 discrete values for progressive monitor scanning with a frame frequency of 50 Hz and 1024 x 640 discrete values for monitor scanning at a frequency of 60 Hz. It features a total image size of 1024 x 1024 pixels and has 1 Mbyte of video memory. It has 256 brightness gradations or colors, can display 2^{24} possible colors and shadows, features a minimal pixel display time of 20 ns, and has a maximal video output rate of 50 Mbyte/s. It can generate vectors at a rate of 640 ns/pixel, generate a character in 140 μs, and delete one or all planes of its video memory or color large areas at a rate of 80 ns/pixel. It can be interfaced with a main computer by any standard MPI bus. The display station is based on a two-processor architecture that permits sharing and parallel performance of processing a high-level description of graphic data and generating a raster representation of the data. The display station consists of a display processor (that has a channel to link with the main computer, equipment for graphic interaction, and a floppy or hard disk storage), a graphic processor that contains a vector generator, a video memory, video outputs, color tables, and a raster-type color monitor. The display station can be used with any microcomputer having an MPI bus (for example, the Elektronika MS 1201.02, Elektronika MS 1211, or Elektronika MS 1212). It can be used with a high-resolution color or black-and-white monitor. Figures 1.

Software for the GAMMA-7.1 Display Station

917G0049C Moscow AVTOMETRIYA in Russian No 4, Aug 90 (manuscript received 16 Jan 90) pp 39-42

[Article by A. A. Buchnev, V. L. Lobkov, and V. G. Sizykh, Novosibirsk]

UDC 681.3.06

[Abstract] The software of the GAMMA-7.1 display station consists of two parts: display processor software and graphic processor software. The display processor software performs the following tasks: formulates instructions and data for the graphic protocol developed for interaction with the graphic processor, sends these instructions to the graphic processor by means of a special mechanism for linking and synchronizing the operation of the display and graphic processors, services the graphic input devices, and services the channels for communication with the main computer. The graphic processor performs the following functions: emulates the operation of the system terminal, provides a functional-raster representation of the output graphic primitives, performs operations on arrays of pixels, formulates a (software) cursor and moves it upon receiving instructions from the display processor, controls the attributes of an image being constructed, controls the scale of an image and frame frequency, and controls the color tables. The software at the applications software level contains a set of subroutines that are executed on the

display processor under the control of the RAFOS or NTS operating system. The software has been constructed to be as compatible as possible with that of the older-model GAMMA-4.2 display station. From a function standpoint these subroutines may be categorized as being intended for one of the following: control (i.e., control such things as color and brightness characteristics, the scale of an image, or the type of operation to be performed with the video memory); plot images; and control the graphic input devices. The graphic processor has been designed so that the data needed to trigger the vector generator are prepared very quickly. The data needed to activate vector generators operating on the basis of the digital differential analyzer method can be prepared within 7 μs. The vector generator can plot a segment 11 discrete values long within 7 μs at a speed of writing into the video memory of 640 ns. The graphic processor may be used to perform real arithmetic operations at the following rates: addition, 110,000 operations per second; multiplication, 46,000 operations per second; and division, 35,000 operations per second. References 5: Russian.

Modeling the Curvilinear Surfaces of a Vehicle's Body

917G0049D Moscow AVTOMETRIYA in Russian No 4, Aug 90 (manuscript received 16 Jan 90) pp 43-49

[Article by B. A. Usov, Minsk]

UDC 681.3.06

[Abstract] Formalized descriptions of existing graphic methods of developing surfaces may be used to formulate mathematical models of the surfaces of a vehicle body. These methods, which are not currently used in computer graphics, may be formulated using the apparatus of the parametrization of algebraic curves. This makes it possible to introduce automation processes into artistic design by using mathematical methods and criteria to correct and refine a shape (in relation to its smoothness, symmetry, design laws, and proportionality) in accordance with the designer's thinking and under his supervision. Although it may not seem so at first glance, the graphic development of a vehicle body is a very laborious and difficult task. Sketches of the various surfaces are made using geometric and projection techniques. Despite the precision of these techniques, each design method only makes it possible to produce one of a set of appropriate surfaces bounded by specified lines. The practice of modern automotive body design demonstrates that a surface produced by elementary graphic plottings that has a shape that meets both aesthetic and design requirements is indeed a rarity. To complicate matters, the literature contains little theoretical information on graphic development of curvilinear surfaces. The methods of mathematically modeling vehicle body surfaces that are examined in the present article are based on the deformation of two types of curvilinear surfaces: cylindroid and conoid. The author's examination proceeds from the principle that deforming a body bounded by the surface of a cylindroid or conoid may result in an infinite number of continuous curvilinear surfaces that depend on the initial surface. The modeling method examined has a good graphic interpretation that has been published elsewhere. The present article includes an example of the mathematical modeling of the deformation of an initial conoid. The initial data for the modeling are the base natural lines of a vehicle body. Figures 5; references 14: Russian.

Developing an Invariant Subsystem for the Geometric Modeling of Objects With a Complex Shape

917G0049E Moscow AVTOMETRIYA in Russian No 4, Aug 90 (manuscript received 16 Jan 90) pp 49-52

[Article by V. N. Gurak and V. A. Ploskiy, Kiev]

UDC 515.2:681.3

[Abstract] One way of expanding the functional capabilities of the invariant nucleus of the geometric modeling subsystems of a computer-aided design system is to include geometric methods of modeling objects with a complex shape, i.e., shaping methods, as one of its components. Methods of forming a geometric object constitute the basis of most existing geometric modeling subsystems, with shaping methods being used comparatively rarely. This is largely due to the great diversity of structures, forms of representation, and algorithms for implementing different shaping methods. Another problem is that shaping methods are based on a diverse set of interpretations and approaches that are not very compatible with one another from the standpoint of use in a geometric modeling subsystem. In view of these considerations, the authors of this article call for the development of a unified approach to using shaping methods that would be convenient to implement on a computer. They propose that the way to accomplish this is by using a decomposition approach, according to which the different existing shaping methods are studied by first breaking them down into their individual components in order to identify those representation methods that are invariant with respect to the distinctive features of computer-aided design systems and convenient to use with them. The following points are made: 1) investigation and ordering of the properties of the components of different methods will make it possible to synthesize the required shaping method on the basis of an a priori specified set of initial conditions; 2) if a shaping method overall meets the conditions of a task and only requires correction, it is advisable that one of the method's components simply be replaced; 3) it is possible to represent several algorithms of different shaping methods in the form of a chain without intermediate transformation of the information such that a specified task would be performed in each node; 4) affording the capability of switching from one method to

another would make one shaping method and its algorithm the base method and algorithm for the user; 5) introducing the individual components of different shaping methods into a geometric modeling subsystem would increase the number of possible different design decisions that can be generated by enabling successive trials of the various components; and 6) theoretical investigations of different shaping methods are simplified by investigating the methods' individual components so as to discover their distinctive features, rational applications areas, and precision. Following this approach will expand the library of transformation components and eliminate the object orientation of component coding systems so as to create an invariant shaping module that can serve as a component of a geometric modeling subsystem. The methods can then be adapted to a specific subject area by developing a service program module to coordinate its terminology and the components' geometric invariants. The shaping system examined here is intended to be included in the Automated Design System Geometric Modeling Subsystem that is being developed by the Computer Science Institute of the UkSSR Academy of Sciences. References 7: Russian.

GROM Geometric Modeling System

917G0049F Moscow AVTOMETRIYA in Russian No 4, Aug 90 (manuscript received 16 Jan 90) pp 60-64

[Article by Ye. V. Biryaltsev, A. M. Gusenkov, I. R. Nasyrov, and A. A. Savelyev, Kazan]

UDC 681.3.022

[Abstract] In computer-aided design [CAD] systems geometric models may be represented in three forms. Descriptive representation makes it possible to describe a specific geometric object whose every element is known. Procedural and nonprocedural representation methods are generally used to specify parametric models of objects. In a procedural approach the model is specified in the form of a program written in a procedural language that describes the process of its construction. In a nonprocedural approach, on the other hand, the model is described in the form of a set of geometric primitives and the relationships that connect them. The GROM geometric modeling system uses all three forms of representation. The nucleus of the GROM geometric modeling system is a geometric processor implemented in the form of an interpreter of a special high-level language. The language of the GROM system is geared toward development of general mechanical engineering sketches by using computer graphics. It may be used as a basis for developing interactive and packaged CAD software for use in mechanical engineering. The system's interpreter gives users the capability of working with eight types of geometric elements—point, segment, graphic text, and arcs of a circle, ellipse, hyperbola, parabola, and Archimedes spiral). Access is available to individual fields (coordinates, attributes) of the geometric elements to permit the performance of arithmetic and comparison operations. A library of mathematical functions is also provided. A "find-init" operator that enables users to construct nonprocedural models is provided. The approach provided in the GROM geometric modeling system thus gives users the capability of constructing and modifying geometric models based on a nonprocedural representation of geometric objects. Experiments performed with the system have confirmed the possibility of using it in a CAD system. References 4: Russian.

Geometric Modeling of Objects With a Physically Inhomogeneous Structure

917G0049G Moscow AVTOMETRIYA in Russian No 4, Aug 90 (manuscript received 16 Jan 90) pp 64-66

[Article by O. P. Kormilitsyn and A. A. Samodurov, Leningrad]

UDC 681.3.06:656.512.2(075.8)

[Abstract] The description of three-dimensional objects in a computer-aided design [CAD] system is generally confined to the geometric characteristics of objects even though such important physical concepts as porosity and inhomogeneity also determine the structure of the objects modeled. Hence the need for both geometric and physical modeling. The authors of the work reported herein propose an algorithmically new integrated design approach that would make it possible to model both the geometric and physical features of objects. They illustrate the workings of their approach by way of the examples of modeling a cylinder with a porous structure and a cylinder with an inhomogeneous structure. The proposed approach has a number of advantages over conventional approaches. First, the set of standard geometric elements is presented with consideration of their internal structure, which expands design capabilities significantly. Second, a standard geometric element is described on the basis of the concept of geometric sets distributed in accordance with a law corresponding to the law governing the distribution of the structure of a real medium. Figures 1; references 4: Russian.

Automated Component Design Subsystem

917G0049H Moscow AVTOMETRIYA in Russian No 4, Aug 90 (manuscript received 16 Jan 90) pp 66-68

[Article by N. V. Revina, L. V. Sokolova, and Yu. Ts. Faytelson, Volgograd]

UDC 681.3.061:658.512.3

[Abstract] Analysis of operations in the field of automating the design of products produced by the machine building sector indicates that the following are especially needed: automatic formulation of sketches of components and subassemblies after the structure of a product's design has been formulated and after the necessary engineering calculations have been made; self-contained

formulation of individual and group sketches of standard and original components; interactive editing of the images of component sketches that have been formulated; and organization of the storage, retrieval, and output of component sketches to the appropriate graphic devices. What is most important when designing an automated component design system is that it be suitable for use as a subsystem of a larger computer-aided design [CAD] system as well as a stand-alone system. It is equally important that designers who are not themselves professional programmers be able to interact with the system in some formal/natural language. Such a system should use several methods of formulating graphic documents that are oriented both toward the sketch and the object. In other words, it should afford the capability of developing two-dimensional models to automate designing and sketching and three-dimensional models to permit the representation of frames, surfaces, three-dimensional elements, etc. The proposed automated component design should further be compatible with or adaptable to different automated workstations. The following approaches should be combined when developing such a system: use of a fund of parametric descriptions of standard components, use of the "version" method of describing components, use of descriptions of integrated sketches, interactive formulation of graphic images based on the use of base primitives, and interactive formulation of sketches of components based on problem- and/or object-oriented funds of images of design elements. Most of the labor expended during the process of developing such a system will go to analyzing and describing the object-oriented part of the system. The approach outlined has recently been used to develop the first version of an automated component design subsystem for use at an automated mechanical engineer's workstation. The subsystem has been developed on the basis of an SM-1420 computer in the OS RV operating system with the RAD-ARM and GRAF-SMGKS program packages. The subsystem has also been used in higher educational institution training programs for the principles of CAD and computer graphics. The subsystem's interactive monitor and procedures for managing the system's data base and archives are also described.

A Subsytem for Interactive Evaluation of the Quality of Blade Cascades in an Automated Turbine Blade Design System

917G0049I Moscow AVTOMETRIYA in Russian No 4, Aug 90 (manuscript received 17 Jan 90) pp 88-90

[Article by O. Yu. Anchugova, A. V. Bezel, and N. U. Tugushev, Sverdlovsk]

UDC 621.438-226.2.001.2:621.3

[Abstract] It is extremely important that designers designing products interactively on computers have timely information about their design in a form that is easy to visualize and understand. This article describes a system that has been developed to provide turbine blade designers with timely information about the quality of the blade cascades that they are designing. The geometry of the cascade and the aerodynamic parameters of the flow (entry angle, reduced velocity at the outlet from the cascade, temperature, deceleration pressure, and initial turbulence of the medium moving in the cascade) serve as the source data. The subsystem provides a quantitative estimate of a blade cascade design from an aerodynamic standpoint. On-screen estimates of key characteristics can be obtained at intermediate points throughout the design process. A final estimate in the form of technical documentation that conforms to the requirements stipulated in the All-Union State Standards is provided at the end of the design process. The new system makes it possible to determine blade cascade characteristics in both subsonic and transonic modes at speeds that are hundreds of times faster than when analogous conventional methods are used. On a YeS-1045 computer (with 120 K), for example, a blade cascade's characteristics may be calculated in about 4 or 5 seconds. The subsystem can be operated in system or self-contained versions and has been introduced at 15 enterprises and organizations throughout the country. It has also been incorporated into the curriculum at two higher educational institutions. In 1979, for example, it was used to design the blade rings of all of the stages of the turbine of the IL-86 airbus' engine. Figures 5; references 3: Russian.

Visualization of Manufacturing Processes in a Tool System for Supervisors at Machine Building Enterprises

917G0049J Moscow AVTOMETRIYA in Russian No 4, Aug 90 (manuscript received 16 Jan 90) pp 90-93

[Article by D. A. Zaytsev and A. I. Sleptsov, Donetsk]

UDC 681.3.084:658.513

[Abstract] Effective supervision of the manufacturing processes implemented at machine building enterprises requires quick assessment of the current status of thousands of components and subassemblies of hundreds of products that are all being produced at the same time. It also requires situational modeling and effective decision-making. All of these are impossible without graphic representation of information. The authors of the present article propose a seven-step approach for creating supervisor instrument systems based on visualization of manufacturing processes by using a special type of loaded Petri time nets. Processes are represented at two levels: the macrolevel (i.e., the production of component sets) and the microlevel (i.e., the production of individual components and subassemblies). At the macrolevel, a standard manufacturing process is described by a net termed the base graph of a product's manufacture. It consists of fragments of two types of Petri nets: constructives and links between them. The microlevel

includes lists of components and nets describing standard processes for manufacturing them. The manufacturing process is modeled in terms of the passage of a flow of blocks corresponding to different product units through standard nets. Copies of the standard nets, i.e., product manufacture planning graphs, are created to store planning indicators and for graphic display of the running status of each product unit. Different forms of information, including tables, line graphs of jobs, and plans for the enterprise's subdepartments, are output as a result of interpretation of the base net model. Petri nets were selected for use in the model because they permit efficient modeling of parallel-sequential and conveyer processes such as the manufacturing processes implemented at a machine building enterprise. Together with a formal mathematical description, Petri nets provide an easy-to-visualize graphic representation that permits visual assessment of the status of a modeling object and different versions of its behavior. The OPERA system has been developed to implement the described approach automatically. The flexibility of the system and absence of any significant constraints on the size of facilities that it can monitor (thanks to the dynamic creation of the descriptors of a net's elements) make it particularly promising. The system has been implemented on an IBM-compatible desktop computer in the MS DOS operating system in the programming language C. It is currently in operation at one machine building enterprise. Figures 3; references 3: Russian.

A Discrete Game on a Line With Information Delays

917G0050A Moscow AVTOMATIKA I TELEMEKHANIKA in Russian No 12, Dec 90 (manuscript received 7 Sep 89) pp 51-59

[Article by A. Yu. Garnayev, candidate of physical and mathematical sciences, Leningrad Construction Engineering Institute]

UDC 518.9

[Abstract] Isaacs and several others after him have examined the need to use mixed strategies in differential games with information delays. This article also examines the problem of developing strategies for an antagonistic multistep game on a line with information delays. The difference is that in the game examined herein, the damage inflicted by the shooter comes not from cartridges but from shell fragments that cause damage both at the site where the shell bursts and in adjacent points. In the game, the shooter maximizes the probability that the target will be damaged by "shell fragments" before it reaches the "bunker." The probability of damage depends on the distance between the point at which the shell bursts and the target. A recurrent formula to determine the value of the game is derived, and optimal strategies for its players are plotted. References: 1 Russian, 7 Western.

Necessary and Sufficient Conditions of Instability of Nonlinear Self-Contained Dynamic Systems

917G0050B Moscow AVTOMATIKA I TELEMEKHANIKA in Russian No 12, Dec 90 (manuscript received 28 Apr 89) pp 59-65

[Article by V. P. Zhukov, doctor of technical sciences, Control Problems Institute, Moscow]

UDC 517.987:519.718

[Abstract] The method of sources has previously been used as a basis for deriving sufficient conditions for the instability of the equilibrium point for smooth and nonsmooth self-contained nonlinear systems as well as for smooth non-self-contained nonlinear systems. In the self-contained case, the class of systems examined had a nonnegative divergence of the vector of the right part of the equation system in some neighborhood of the equilibrium point such that in some vicinity of this point, no matter how small, the divergence had to be positive in some set of points. This article, on the other hand, derives necessary and sufficient conditions of instability for smooth nonlinear self-contained systems, thus eliminating any constraints on the sign of the divergence in the vicinity of the equilibrium point of such systems. The method of sources is used to derive necessary and sufficient conditions for the instability of the equilibrium states of dynamic objects described by a system of arbitrary-order Cauchy-type nonlinear ordinary differential equations. Figures 1; references 5: Russian.

Synthesis of Stabilization Systems

917G0050C Moscow AVTOMATIKA I TELEMEKHANIKA in Russian No 12, Dec 90 (manuscript received 18 Jul 89) pp 66-74

[Article by B. S. Darkhovskiy, candidate of technical sciences, G. G. Magaril-Ilyayev, candidate of physical and mathematical sciences, State All-Union Red Labor Banner Order Scientific Research Institute of Integrated Automation (TsNIIKA), Moscow]

UDC 517.987:62-501.42

[Abstract] The problem of stabilization is one of the most prevalent during the synthesis of automated process control systems. It occurs both as an independent problem and as part of more complex control problems. From a formal standpoint, it is a problem of optimal control. In rather general situations such as the problem of a nonlinear multidimensional system or the problem of constraints on control variables, optimal synthesis is, for all practical purposes, impossible. One alternative is suboptimal synthesis. Another alternative that has recently enjoyed increased popularity is the method of synthesizing control systems based on the idea of local optimization. The study reported herein examines the method of local optimization in stabilizing dynamic

systems. The concept of the roughness of a closed stabilization system is examined, and conditions guaranteeing the roughness of a system that is closed with respect to the method of local optimization are established. According to the approach proposed, the object undergoing adaptive stabilization is subjected to parametric description, i.e., it is described in terms of some parameter vector. The adaptation problem is then reduced to adapting the equation system to possible changes in this vector during the process of the object's functioning. Proceeding from a roughness estimate, the parametric region is divided a priori into nonoverlapping subregions, with each being "serviced" by a separate controller. In other words, if the parameter vector changes but still remains within the confines of one and the same region of roughness, the control may be calculated on the basis of the established model, and the closed system will not lose its specified stability margin. When this is the case, no adaptation is necessary. When the object's parameters move from one region of roughness to another and adaptation becomes necessary, different adaptation methods may be used. If the number of regions of roughness into which the range of change in parameters has been subdivided a priori is small, the adaptation process consists simply of selecting from a small list of previously established controllers. If the number of regions of roughness is large, the adaptation procedure may entail making estimates of the object's parameters until that time when the confidence interval of this estimate is within the roughness range calculated on its basis. In both versions, the adaptation process is completed in a finite number of steps. What is important here is that the goal of adaptation is to ensure that the closed system will have a specified stability margin. This does not require the synthesis of procedures guaranteeing the convergence of estimates of the object's parameters and their true values. References 6: Russian.

Stabilization of Dynamic Systems Under the Effect of Indeterminate and Random Disturbances

917G0050D Moscow AVTOMATIKA I TELEMEKHANIKA in Russian No 12, Dec 90 (manuscript received 13 Oct 89) pp 75-84

[Article by Yu. S. Kan and A. I. Kibzun, doctor of physical and mathematical sciences, Moscow Aviation Institute]

UDC 517.977.5

[Abstract] A number of works have examined the problem of control during the simultaneous effect of random and unspecified factors. On the one hand, this is because, in actual practice, it is rarely the case that the statistical characteristics of a system being synthesized are determinate a priori. On the other hand, the increasing requirements that are being imposed with regard to the quality of control systems are making it necessary to use increasingly adequate mathematical models of dynamic objects when synthesizing control. This, in turn, necessitates giving careful consideration to uncontrollable factors when constructing models. A priori information about such uncontrollable factors makes it possible to classify them as either random or indeterminate. Failure to perform this classification with adequate care can reduce the model's exactness and thus reduce the quality of the resultant control under real conditions. Hence the extreme importance of developing methods of synthesizing control in the presence of the simultaneous effect of different types of uncontrollable factors. Previous examinations of the problem have not given adequate consideration to all aspects of the problem. The authors of this article have examined the problem of stabilization in the sense of guaranteeing the dissipativity (from a probability standpoint) of a quasilinear dynamic system subjected to indeterminate and random disturbances and with random measurement errors. The problem is solved in a class of linear control laws by using Lyapunov vector functions. These functions are used as a means of interpreting the nonlinearity in the system's motion equations as a weak link between identification and control subsystems. The authors also study the possibility of improving the quality of stabilization by using a nonlinear control law in the case of exact measurement of the phase vector. References 15: 14 Russian, 1 Western.

Computer Vision System Hardware

917G0052A Moscow IZMERITELNAYA TEKHNIKA in Russian No 12, Dec 90 pp 8-9

[Article by N. P. Lavrentyev and V. G. Nikitayev]

UDC 681.772.7.049.771.14

[Abstract] Modern automated image processing systems feature built-in video architecture. Compared with peripheral image processing systems, such built-in "computer vision" systems are more universal, they process information faster, and they have more video memory. They are further distinguished by their compactness, reliability, value, and portability. Computer vision systems also reflect a key direction in creating an intelligent man-machine interface in fifth-generation computers. This article examines computer vision system hardware developed on the basis of type DVK domestic series-produced microcomputers. The equipment described includes a transducer that conditions an analog video signal in accordance with a complete television signal, an input/output device that converts incoming information by means of an analog-to-digital converter, a picture monitor with a digital-to-analog converter, a video memory, a video processor, and an interactive processor. The system can produce an image consisting of 512 x 512 pixels, produce up to 2^{24} color shades, input a television image frame into its video memory in 40 ms, and store two frames simultaneously. The information system can operate in three modes: data exchange between the I/O device and video memory, data exchange between the video memory and computer, and data exchange with

peripherals. An image consisting of 512 x 512 pixels with a 3 x 3 kernel can be scanned in 48 ms; a 15 x 15 kernel requires about 1,400 ms. Figures 1; references 3: Russian.

Coordinate Transformation Method for Adaptive Image Segmentation

917G0052B Moscow IZMERITELNAYA TEKHNIKA in Russian No 12, Dec 90 pp 9-10

[Article by V. G. Nikitayev and S. N. Sharonov]

UDC 531.71.087.9

[Abstract] Isolating the pixels corresponding to the object being analyzed is an important step in most image processing tasks. The image is subdivided into individual regions with uniform properties. This procedure is termed image segmentation. Existing image segmentation procedures are generally heuristic and yield qualitative results for a rather narrow class of images. This article examines a new image segmentation method that uses a priori information about the distribution of regions in the image. During the process, the image is represented in the form of a pyramid. Each node of this pyramid corresponds to a square segment of the image (the sizes of these segments decrease from the pyramid's apex to its base). The process is implemented in two stages: decomposition (breakdown) and grouping (merging). In the decomposition stage, a nonuniform fragment of the image is broken down into smaller lower-level fragments. The subdivision is stopped if the fragments are uniform or if the base of the pyramid is reached. The uniform fragments obtained in the first stage become the source information for the second stage. If the condition of uniformity is met, the fragments are combined (merged) into a region. The proposed method is simple to implement on a computer. Experimental studies of the segmentation procedure for 256 x 256 x 4 images containing regions of uniform brightness demonstrated that the proposed method provides the same degree of precision as do image segmentation procedures but is faster by a factor of 1.5 to 2. References 4: 1 Russian, 3 Western.

Automating Visual Inspection of the Uniformity of a Material's Microstructure

917G0052C Moscow IZMERITELNAYA TEKHNIKA in Russian No 12, Dec 90 pp 11-12

[Article by N. P. Lavrentyev, V. G. Nikitayev, and V. P. Pimenov]

UDC 620.163:620.18

[Abstract] One method of inspecting the uniformity of the microstructure of a material is visual analysis of the location of local nonuniformities on a specially prepared surface of the material. In the absence of structural nonuniformities, the local nonuniformities will be rather evenly distributed. A structural nonuniformity may appear in the presence of small chains consisting of relatively closely spaced local nonuniformities. The degree of nonuniformity will be determined by the length, shape (piecewise-linear, V-shaped, etc.), and "structure" of the chain (i.e., by the size of the local nonuniformity or number of nonuniformities per unit length of the chain). This article examines an algorithm and software for automating this type of inspection of a material's structure by using the ATLANT robovision system. The process of visual inspection is essentially reduced to isolating structural nonuniformities in the image, computing their features, and automatically classifying materials in accordance with existing structural state scales. Special attention is paid to the tasks of selecting the optimal window size and the attributes characterizing the given class of images. Figures 1; references 6: 5 Russian, 1 Western.

Experimental Studies of a Method of Considering the Effect of the Atmosphere When Making Linear Measurements

917G0052D Moscow IZMERITELNAYA TEKHNIKA in Russian No 12, Dec 90 pp 14-16

[Article by V. V. Vinogradov, N. N. Obolenskiy, A. M. Andrusenko, and I. A. Mishchenko]

UDC 531.71.088.228

[Abstract] Others have examined the possibility of using the dynamic properties of the atmosphere to determine the integral refractive index of air during linear measurements, developed a method for doing so, and presented research indicating that it is possible to reduce the measurement error to 5×10^{-7} as compared with existing methods, including round-the-clock observations. No final judgment regarding the effectiveness of the proposed method of considering the effect of the atmosphere on linear measurements is possible, however, unless the results are compared with standard data. For this reason, the authors of this article have analyzed the results of experimental research on the proposed method and have estimated its effectiveness from a precision standpoint. The equipment, procedures, and equations used in implementing the procedure are described. A sample calculation is then made to illustrate the procedure's use. After analyzing the sample calculations, the authors conclude that the proposed version of a correlation approach is feasible for use in range finding. They call for the further development of quantitative criteria for ensuring a specified measurement precision under specific meteorological conditions and for a selected measurement route. They also recommend that the procedure be compared with measurement results obtained by using refractometers. They further recommend that special instruments, i.e., refractometers, be used to measure the meteorological parameters required to calculate the refractive indices at the ends of the route so as to

make it possible to automate the information gathering and processing process. Tables 1; references 6: Russian.

Investigation of the Nonlinearity of the Conversion Characteristics of Fine-Wire Bolometers to Measure a Laser's Radiating Power and Energy

917G0052E Moscow IZMERITELNAYA TEKHNIKA in Russian No 12, Dec 90 pp 20-21

[Article by V. M. Kuzmichev and A. V. Zolotaykin]

UDC 621.37.089.5.088:621.375.826

[Abstract] Wire bolometers are used to measure the power of continuous-wave laser radiation and the energy of pulsed laser radiation. Owing to their high radiant stability, wire bolometers may be used to make measurements over a broad dynamic range without resorting to attenuators. The authors of the study reported herein studied the nonlinearity of the conversion characteristics of fine-wire bolometers in an effort to increase their measurement precision. They derive a set of relationships that makes it possible to analyze the conversion characteristics of wire bolometers made of various materials in any segment of the spectral range. Specifically, they present dependences that make it possible to determine the systematic error of measuring the power and energy of laser radiation that arises as a result of the nonlinearity of the conversion characteristics. The normalized conversion characteristics obtained from the relationships presented may be used for bolometers 4 to 20 μm in diameter. Figures 2; references 5: Russian.

Features of Using the IDV-3 Instrument to Measure the Radiation Wavelengths of Pulsed Lasers

917G0052F Moscow IZMERITELNAYA TEKHNIKA in Russian No 12, Dec 90 pp 22-23

[Article by A. Ye. Balakhnin, V. I. Bobrik, Ye. G. Levchenko, V. V. Taranov, V. L. Tkachenko, and Yu. F. Tomashevskiy]

UDC 621.373.826:621.317.365

[Abstract] The creation of frequency-tuned lasers with electronic control and the promise of using them in such fields as spectroscopy, laser technology, and environmental protection has given special urgency to the development of automatic wavelength meters with a high speed and precision and with the capability of being interfaced with laser computer systems. The Siberian State Scientific Research Institute of Metrology [SNIIM] has developed the IDV-3 wavelength meter for pulsed lasers and has prepared it for production. This article presents and discusses the results of laboratory studies of the IDV-3. Special attention is paid to the effect that the parameters of the laser being measured exert on the precision of measurements made when using the IDV-3. Specifically, the spectral width of the line, the angular and linear deviations of the beam, and the dynamic range of the instrument are all analyzed in detail. It is concluded that using the IDV-3 under laboratory conditions makes it possible to significantly improve the precision and simplify the implementation of spectroscopic measurements. The authors also conclude that work in the area of further improving wavelength meters for pulsed lasers should be directed toward increasing their speed and expanding their dynamic range by replacing the charge-coupled device [CCD]-based type-transparency matrix and by creating multiple-frequency meters based on multiple-beam Fizeau interferometers. Figures 2; references 2: Russian .

Determining the Oscillation Period of Low-Frequency Signals

917G0052G Moscow IZMERITELNAYA TEKHNIKA in Russian No 12, Dec 90 pp 30-31

[Article by A. V. Voloshko and O. V. Kotsar]

UDC 621.2.08:53.088.3

[Abstract] Most algorithms for processing measurement results by microprocessor or microcomputer are based on a harmonic analysis of samples of the instantaneous values of analog signals. Research on the errors arising during such processes shows that in addition to being affected by errors related to rounding, the finiteness of the microprocessor's digit system, etc., the measurement results obtained when using such algorithms are also greatly affected by the instability of the period of the signals being measured. Thus, developing effective hardware and software to measure the frequency of periodic signals and using the measurement results to correct errors caused by deviations in a signal's period from the rated value are of extreme importance. The authors of this article propose a method of determining frequency by using a KR580VI53 timer. Trials of the proposed procedure demonstrated that the increase in precision obtained when the procedure is used to determine a network's frequency (especially when it is unstable) results in a 10 percent reduction in the error of determining the amplitude of the fundamental harmonic, a 60 percent reduction in the error of determining the amplitude of the second through fifth harmonics, and a 100 percent reduction when determining the amplitude of harmonics above the fifth. Figures 2; references 3: Russian.

Measuring the Electromechanical Time Constant of a Direct-Current Drive

917G0052H Moscow IZMERITELNAYA TEKHNIKA in Russian No 12, Dec 90 pp 31-32

[Article by A. I. Ankudinov, V. I. Kravets, and K. A. Ankudinov]

UDC 621.372.512.029.33:621.317.741

[Abstract] The direct-current electric drive is a component of a broad class of automatic control systems. An

electric drive's dynamic characteristics are greatly affected by its electromechanical time constant. This constant changes significantly as a drive operates depending on environmental conditions and on the drive's operating conditions. The existing graphic-analytical methods of determining the time constant are not very precise and are very laborious owing to complete recording of the electric drive's characteristics. The authors of this article describe a precise and highly productive method and device for measuring the electromechanical time constant of a direct-current drive while the drive is operating. The proposed circuit for measuring the electromechanical time constant is similar to existing ones in that it includes an integrating RC circuit, a voltage extreme indicator, an electronic switch, a differentiating circuit, a separately activated trigger, a pulse generator, a two-input logic circuit, and a counting circuit and display board. Unlike its existing counterparts, however, it also includes an amplitude detector. The proposed device and method are an order of magnitude more precise and productive than the existing ones, and make it possible to take measurements while the direct-current drive is operating. Figures 2; references 6: Russian.

The DS-86 Real-Time Operating System

917G0046A Moscow MIKROPROTSESSORNYYE SREDSTVA I SISTEMY in Russian No 3, May-Jun 90 (manuscript received 17 Jan 89) pp 36-38

[Article by M. A. Alekseyevskiy, I. A. Yelnik, and Ye. I. Rozenshteyn]

UDC 681.3.06

[Abstract] The DS-86 executive real-time operating system to control data processing and transmission processes is designed for use with the Elektronika 60 computer. The system is ROM resident, which makes it much more reliable and is a necessity when developing systems with strict constraints with respect to weight and size characteristics (specifically, single-board built-in microcomputers). The DS-86 operating system has been designed for the single-board Elektronika S5-41 microcomputer and is based on a modular principle. This makes it easy to select the required system configuration, simplifies the process of maintaining the operating system, and maximizes the savings of ROM and RAM resources. The following are among the features afforded by the DS-86 operating system: a centralized mechanism for processing interrupts, parallel execution of tasks in accordance with priorities, a time dispatching system, time synchronization and synchronization of access to resources, control of exchange with peripherals, simple interface between user and system, dynamic distribution of RAM, and standardized mechanism for working with queues. Working with the DS-86 operating system in its maximal version requires about 1,500 words of ROM and 65 words of RAM (allowing for 25 words in the system stack). A minimal version of the DS-86 operating system has been configured for two controllers implemented on an Elektronika S5-41 microcomputer and intended for automated control of manufacturing equipment. In these controllers, the DS-86 system occupies 240 words of ROM and 32 words of system RAM (including 20 words of the system stack). The system services only one peripheral. Figures 1; references 3: 2 Russian, 1 Western.

A Tool System for Creating Automated Workstations

917G0046B Moscow MIKROPROTSESSORNYYE SREDSTVA I SISTEMY in Russian No 3, May-Jun 90 (manuscript received 26 Dec 88) pp 40-43

[Article by I. B. Kirichenko]

UDC 681.3.06

[Abstract] The principle of creating automated workstations based on standard design solutions with adjustments for specific manufacturing systems is widely used as a way of reducing the costs of designing, introducing, and maintaining automated systems. A tool system based on the YeS1840 personal computer has been proposed to simplify the task of making such adjustments. The tool system is designed for automated workstations with different categories of users involved in flexible computerized manufacturing systems [FCMS]. From a software standpoint, the system represents a number of standardized components (modules) permitting user interaction with applications packages. The system includes a set of tools that facilitate adjustments for different problem-oriented areas. The programmer-engineer configures the modules and special packages in accordance with the purpose of the given automated workstation, and the user (who is not himself a professional programmer) uses the prepared system as a tool in his work, adjusting it for specific applications. No special training is required to use the tool system, which is based on a graphic menu. This article illustrates the features and operation of the proposed tool system by way of the example of designing an automated workstation for a process engineer responsible for controlling an FCMS. The use of the proposed tool system in the following aspects of designing the aforesaid FCMS are discussed: technological preparation of production, technical and economic planning, online production control, accounting, management of material and technical supply, and production of a finished product. Figures 4; references 5: Russian.

An Analysis of the Experience of Introducing Large Development Systems for Creating Programs and Methods of Selecting Them

917G0046C Moscow MIKROPROTSESSORNYYE SREDSTVA I SISTEMY in Russian No 3, May-Jun 90 (manuscript received 4 Apr 88) pp 43-45

[Article by L. G. Osovestskiy and A. A. Shtrik]

UDC 681.3

[Abstract] The increasing requirements regarding software quality and the need to reduce the costs of software development have compelled software planners to pay special attention to selecting software development tools and devising new development systems for use in creating software. Analysis of the experience accrued in introducing and operating such development systems indicates that the most important factors affecting the selection of a software development technology are the subject area of the development system to be introduced and the objectives to be achieved by introducing the system. The primary objective of the authors of the study reported herein was to analyze the problems arising during the introduction of a development system, formulate recommendations regarding the organization of the introduction process, and examining approaches selecting a development system depending on the real characteristics of the software being created and the conditions of its development. They conduct their analysis by way of the example of a specific software development automation system, i.e., the RUZA system. (The

RUZA system is an adjustable cross-system for automating the development of complex program sets operating mainly in real-time on different types of built-in computers. The RUZA system operates on YeS computers and automates all of the main steps in creating software developed in assembler language and macrolanguage within the framework of the PROMETEY technology.) The authors identify the five factors that are primarily responsible for efficient development of quality software: adequate attention to the task of developing specifications for the software being created, the use of efficiently organized interactive access to the development computer, the presence of a centralized design data base with well-developed access to stored information, monitoring of the course of the development process to discover bottlenecks in the software design process, and the use of a common technology supported by standard tools for different types of built-in computers. Data on 87 different software development plans that were gathered on a special questionnaire developed by the authors helped the authors develop a list of those parameters and indicators that are used most frequently to characterize software development technology and development systems (these are summarized in tabular form). The authors conclude that the software development systems and processes may be made more efficient by systems research and analysis of the functional characteristics of software plans, the characteristics of software development automation systems, and the objectives of introducing them. They further conclude that, unfortunately, none of these seems to be occurring in actual practice. Instead, the positive results that are being achieved are the results of the evolutionary development of different directions in the technological support of software development, including methods of selecting and introducing a software development technology. Tables 2; references 5: Russian.

A Control Microcomputer Based on a Series K588 LSI Circuit Microprocessor Set

917G0046D Moscow MIKROPROTSESSORNYYE SREDSTVA I SISTEMY in Russian No 3, May-Jun 90 (manuscript received 15 Dec 87) pp 46-47

[Article by V. I. Dzhigan]

UDC 681.326.34

[Abstract] The microcomputers of the Elektronika family are currently being widely used as controllers. In a number of cases, however, series-produced microcomputers belonging to this family cannot be used owing to their high power consumption and comparatively low range of operating temperatures (between +5 and +40°C). This article describes a microcomputer based on a series K588 LSI microprocessor set. The proposed microcomputer, which does not consume a great deal of power, was developed for use in controlling phased arrays. The proposed phased array controller is a 16-bit microcomputer whose central processor implements the instruction system of the Elektronika 60 microcomputer. The microcomputer's RAM is in the form of two storages: lower- and higher-order bytes. Because of the need to make multiple revisions during the stage of debugging the phased array control algorithms, the proposed microcomputer's ROM is based on a KM558RR3 RePROM. The memory cells of the RePROM LSI circuit are addressed by means of KM558RR3 LSI internal registers, and the module's operation is controlled by a K588IR1 addressable mode register, memory controller, and write-and-erase cycle driver. A voltage of 24 V is required to reprogram the KM448RR3 LSI circuit, and a voltage of 18 V is required to erase it. The ROM requires 220 mW in a storage mode and 840 mW in an address mode. The central processor's initial start-up and stop modes are specified in a unit of start-and-stop registers. The control microcomputer is based on circuit boards 170 x 300 mm in size. The overall dimensions of the microcomputer do not exceed 250 x 325 x 160 mm, and it does not use more than 2.5 W. Its range of operating temperatures extends from -10 to +70°C. An adapter is available to connect channels of the microcomputer responsible for controlling a phased array to a microcomputer of the Elektronika family in a debugging mode. Figures 1; references 6: Russian.

Principles of Interfacing Microcomputers With Parallel I/O Channels

917G0046E Moscow MIKROPROTSESSORNYYE SREDSTVA I SISTEMY in Russian No 3, May-Jun 90 (manuscript received 13 Oct 87) pp 47-50

[Article by A. A. Grigoryev and A. I. Fedosova]

UDC 681.325

[Abstract] The intensive introduction of computer technology into the sphere of automating scientific research and manufacturing processes has made the problem of interfacing peripherals and microcomputers more important than ever. Parallel data transmission channels with asynchronous exchange protocols are widely used to establish links with peripherals. Interfacing such channels with the system channel of a microcomputer requires the development of special interface modules. This article examines the structure of parallel asynchronous exchange. The following three versions of using a parallel channel in the protocol for asynchronous parallel exchange are examined: 1) the channel is monopolized by the source, i.e., data enter the channel upon a drop in the synchronizing signal of the source and remain active until the next moment of issue; 2) the channel is occupied at the source's initiative, i.e., data are sent via the low level of the source's synchronizing signal, which acts as a data strobe in this case; and 3) the channel is occupied at the receiver's option, i.e., data are sent along the high level of the receiver's synchronizing signal, which serves as the receiver's demand for a transmission. Special attention is paid to the microcomputer's system channel and parallel channel adapters. Also included are

diagrams of a parallel asynchronous exchange channel, time diagrams of an asynchronous exchange, a channel for bidirectional asynchronous exchange, the system channel of a microcomputer, adapters for an asynchronous input channel and for an asynchronous output channel, and a KR580IK55 LSI circuit. Figures 7; references 3: Russian.

System for Recording and Express Analysis of Signals

917G0046F Moscow MIKROPROTSESSORNYYE SREDSTVA I SISTEMY in Russian No 3, May-Jun 90 (manuscript received 1 Aug 89) pp 50-53

[Article by A. A. Ursatyev, S. L. Sapozhnikova, and S. A. Tarasenko]

UDC 621.397.96:681.3

[Abstract] A system has been developed to analyze reflections from components of the ocean-atmosphere system and from marine radar targets. The system is based on an Elektronika 60 or DVK microcomputer that records echo signals, stores experimental data on long-term information carriers, and processes the data. The new recording and analysis system is a valuable tool inasmuch as experimental studies such as those supported by the new system are required for full-scale tests. Furthermore, the static characteristics of reflections from objects above the water and on the sea's surface serve as the basis for estimating the parameters of radar echo signals and developing optimal detection algorithms. The new recording and express analysis system operates in conjunction with pulsed incoherent radar stations. The information collected is similar to television information. The proposed system converts the video signal into digital form, the observation data are stored, and radar images that are preliminarily written into the system's RAM or on a peripheral information carrier are displayed on standard plan position indicators. The system's software is geared toward online estimation based on a comparatively small amount of samples of key statistical characteristics, i.e., spectral-correlation and probability distribution laws governing the echo signals' amplitudes. The amount of information that can be recorded by the new system may be increased by using an electronic disk type memory. The system permits user interaction, which makes it possible to perform the following tasks: scan the measurement results in any direction in a two-dimensional data file, suppress anomalous observations by one-dimensional filtration of the source data files, and obtain estimates of signals' probability characteristics. The software required to support the system occupies 500 words of RAM and operates with any version of the RAFOS operating system. The system may also be used with the RT-11 operating system (in which case 15,000 words are required for data storage). The fact that the system uses a nonvolatile electronic disk makes it reliable and efficient under actual operating conditions. Figures 6; references 6: Russian.

STZ-2M Robovision System

917G0046G Moscow MIKROPROTSESSORNYYE SREDSTVA I SISTEMY in Russian No 3, May-Jun 90 (manuscript received 30 Jan 89) pp 54-56

[Article under the "Robotics" rubric: "STZ-2M Robovision System"]

[Abstract] The STZ-2M robovision system was developed at the Novgorod Scientific Research Institute of Electromagnetic Components. It is intended to read, write, store, and preprocess optical information formulated by image sensors in charge-coupled devices. Owing to its modular design, the system can be given capabilities tailored to the specific task at hand. The STZ-2M robovision system has an illumination of 1 to 800 lux and an output code word length of 6 bits. It processes information between frames at a speed of 4.6 Mbyte/s, exchanges information with a peripheral Elektronika 60 microcomputer at a speed of 0.09 Mbyte/s, and has a maximum rate of exchange with a peripheral microcomputer amounting to 0.5 Mbyte/s. The STZ-2M system can have up to 50 spatial filters. It has 16 kbytes of firmware and 0.5 Mbytes of memory. The STZ-2M system features a window format of 360 x 576 points and a frame time of 3 seconds and is capable of performing 16 logic and 16 arithmetic operations between frames. The STZ-2M robovision system consumes 0.8 kW and has overall dimensions of 266 x 452 x 560 mm. Figures 2; references 5: Russian.

Visual Perception System for Industrial Robots and Robot Systems

917G0046H Moscow MIKROPROTSESSORNYYE SREDSTVA I SISTEMY in Russian No 3, May-Jun 90 (manuscript received 24 Feb 89) pp 56-57

[Article by I. I. Dunin-Barkovskiy and V. A. Klevalin]

UDC 621.865.8:681.586.5

[Abstract] Robovision-based visual perception for industrial robots and robot systems promises to increase these robots' efficiency and reliability significantly. When working with raster objects that are well contrasted and illuminated it is advisable to use binary-type robovision in which the image is coded with respect to two brightness gradations. The method of coding in the form of a sequence of line coordinates (i.e., line-to-line coding) in which the coordinates of the white-and-black and black-and-white brightness differences along each television line are stored, has a number of advantages. The code of an image developed using the line-to-line method is generally shorter than that developed by using the raster method. The line-to-line coding method is, for example, advantageous when coding an image consisting of 256 x

256 pixels provided the image does not contain more than 7,000 brightness differences in the image (about 30 per line). Using the line-to-line method of coding thus requires less memory (by a factor of 2.5 to 5). The line-to-line method also results in a gain in processing speed (by a factor of 1.5 to 2, with the largest gains being achieved with the simplest images). This article examines the structure of the MSI-1 robovision system with line-to-line coding. The system is compatible with a Q-bus and has been designed in the form of an Elektronika 60 half-board. The coordinate memory consists of 4,096 9-bit words with digitization of an image consisting of 400 x 288 pixels. The coordinate memory is accessible from the microcomputer's processor. The method of connecting the coordinate memory depends on the industrial robot's control system and on the software used. Software has been developed for the MSI-1 robovision system that makes it possible to input and process images, segment them, describe and recognize objects, assign them a set of attributes, trace the contour of an object, and compute its attributes. Figures 1; references 3: 2 Russian, 1 Western.

Rapid Production of Half-Tone Images for Mechanical Engineering Automated Design Systems

917G0046I Moscow MIKROPROTSESSORNYYE SREDSTVA I SISTEMY in Russian No 3, May-Jun 90 (manuscript received 26 Aug 88) pp 58-61

[Article by S. Ye. Bogomolov]

UDC 681.3.06

[Abstract] The GAMAYuN set of interactive systems for two- and three-dimensional modeling was developed within the framework of the Automated Designer's Workstation software developed by the Office of the Chief Designer of Automated Design Systems at the ZIL [Moscow Automotive Institute imeni Likhachev] Production Association in 1984-1988. The GAMAYuN system is intended for use in creating, storing, visualizing, and revising geometric models of products. The system makes it possible to create elementary bodies (parallelepipeds, cylinders, cones, spheres, pyramids, prisms, ellipsoids, bodies of revolution, profiles, etc.), arrange them in space, and use them as a basis for creating more complex bodies by performing the operations of union, subtraction, and intersection. Projections and cross-sections of three-dimensional objects may be depicted either in a skeletal mode or with their nonvisible lines removed. The system may be implemented with two types of automated workstations: a superminicomputer or a workstation. This article examines the use of the GAMAYuN system for rapid production of halftone images in mechanical engineering automated design systems. The following are among the specific topics covered: the main algorithms used, step-by-step transformations, the evolution of a program to fill triangles, practical applications, and depiction of the performance of theoretical set operations on bodies. Figures 10; references 7: 5 Russian, 2 Western.

Four-Channel Analog-to-Digital Converter

917G0046J Moscow MIKROPROTSESSORNYYE SREDSTVA I SISTEMY in Russian No 3, May-Jun 90 (manuscript received 6 Jul 88) pp 64-66

[Article by Yu. A. Orestov and N. N. Ivontyev]

UDC 681.327

[Abstract] This article describes a four-channel analog-to-digital converter that is intended to convert analog signals in measurement and control systems into their digital equivalent. The converter includes a programmable I/O device (KR580VV55A microcircuit) and a K1108PV2A analog-to-digital converter, which is a 12-bit precision, high-speed, functionally complete sequential approximation analog-to-digital converter with a conversion time of 2 μs. The process of converting analog signals into digital code in each of the four-channel analog-to-digital converter's channels consists of three cycles: sequential feed of trigger and read enable signals from the port programmed for information output, conversion of the analog signal to digital code, and reading of the converted data to the controller's intermodule data bus through two ports programmed for input upon receiving a read enable signal that switches the leads of the analog-to-digital converter's circuits from a high-impedance state to an active state. The conversion time is limited by the speed of the AOT101AS optronic amplifiers and amounts to 70 μs for one channel. The converter has an input voltage range of 0 to 5 V, 11 stable output bits, and a modular design. It fits on one board with dimensions of 220 x 232 mm. Figures 5.

Business Graphics Package for the Elektronika 85 Personal Computer

917G0046K Moscow MIKROPROTSESSORNYYE SREDSTVA I SISTEMY in Russian No 3, May-Jun 90 (manuscript received 26 Aug 88) p 66

[Article by V. N. Chernyavskiy and N. I. Degtyar]

UDC 681.3

[Abstract] When personal computers are used in automating institutional work, it is useful for the end user to be able to represent the dependences between data in graphic form. For this reason, the applications software for the Elektronika 85 personal computer includes the GRAF-85 business graphics package. The GRAF-85 package organizes the source data for plotting graphs in the form of cells of a spreadsheet. The GRAF-85 business graphics package allows users to: formulate and store source data in the form of a table; create different types of graphs; formulate graphs (including headings, axis labels, geometric parameters, and scales); store

descriptions of graphs on magnetic carriers and quickly restore images of the graphs based on existing descriptions of them; correct the description of graphs; and output graphs to a display screen and/or printer. Users can interact with the GRAF-85 system through a menu. The GRAF-85 system functions in the INMOS-85 operating environment (version 1.2 or higher), and the texts of the package's programs are written in C. The package may be used alone or as part of an integrated package with the TABLITSA-85 table processing package. It can also be used to process data from relational data bases such as the BAZA-85. Since the third quarter of 1988, the GRAF-85 package has been provided with a library of algorithms and programs by the Berdyansk Division of the Information Science Problems Institute [IPI] of the USSR Academy of Sciences.

Matching a YeS1840 With the Interface of an Elektronika DZ-28 Microcomputer

917G0046L Moscow MIKROPROTSESSORNYYE SREDSTVA I SISTEMY in Russian No 3, May-Jun 90 (manuscript received 22 Feb 89) pp 66-67

[Article by Yu. Ch. Gaydukevich, V. M. Marchenko, N. I. Domarenok, and I. G. Moroz]

UDC 681.327.8

[Abstract] As the computer technology of instruments used in physical experiments, process control systems, and information processing systems has advanced, it has become necessary to replace their control computers with improved and more powerful computers. One such case is that of the II-42T television parameter system, which uses an Elektronika DZ-28 microcomputer. A new interface has been developed to make it possible to link the Elektronika DZ-28 with a YeS1840 personal computer. A new module extender board has also been developed to match their interfaces. The new board is mounted in the unit of the YeS1840 processor and connected to the system bus through an SNP34S-135 free plug. The distinction of the new interface is connected with the fact that in the YeS1840 data exchange occurs along one bus, whereas in the Elektronika DZ-28 it occurs along two. Bidirectional bus drivers were therefore used to match the different data buses. By developing a method of connecting a YeS1840 to the II-42T television parameter system, the authors made it possible to increase the latter's speed, use a high-level language when developing software for the system, and simplify control of the system by giving users the capability of interaction through an on-screen menu format. Figures 1.

Connecting an MS6106 Color Video Monitor to an Iskra 1030.11 Personal Computer

917G0046M Moscow MIKROPROTSESSORNYYE SREDSTVA I SISTEMY in Russian No 3, May-Jun 90 (manuscript received 29 Mar 89) p 68

[Article by V. V. Glukhenkiy, A. N. Makeyenok, V. I. Penskoy, and V. D. Romasevich]

UDC 681.3.015

[Abstract] Many Iskra 1030.11 personal computers are furnished with black- and-white display screens even though their controllers permit the use of a color video monitor. This article examines the problem of connecting an MS6106 color video monitor to an Iskra 1030.11 personal computer. Connecting an MS6106 and Iskra 1030.11 requires assembling an interface circuit that can easily be built into the video monitor. It consists of five signal conditioners to ensure that the signals at the control inputs of the MS6106 will be of the required level. An emitter repeater buffers the line sync pulse signal. The frame sync pulse signal is buffered in another transistor and inverted. To eliminate noise and cross-interference, all signals from the computer must be connected by screened conductors. When the Iskra 1030.11 operates with a color video monitor, individual portions of the image flicker on screen with the flickering frequency of the cursor. This parasitic effect may be eliminated by connecting a jumper on the KMOI-2 printed circuit board of the Iskra 1030.11. The authors have also experimentally established that connecting high-quality filter capacitors (0.04 to 0.1 μF) to the power supply circuits on the video monitor's boards improves the image quality significantly. Figures 2; references 4: Russian.

A Universal Terminal Device Controller Based on a K1816VYe35 Single-Chip Computer

917G0046N Moscow MIKROPROTSESSORNYYE SREDSTVA I SISTEMY in Russian No 3, May-Jun 90 (manuscript received 25 Apr 89) p 69

[Article by Ye. V. Malyukeyev and I. G. Shatov]

UDC 681.323

[Abstract] This article describes a universal terminal device controller that is based on a K1816VYe35 single-chip computer. The controller is designed to be connected to the IRPS interface of peripherals with a parallel 8-bit interface (for example, a punch, printer, or graph plotter). Its principal distinguishing feature is its built-in K1816VYe35 single-chip computer, which diagnoses the device connected to it in accordance with a program written in its RePROM (K573RF2). Along with an interface conversion circuit, the single-chip computer also has a bus to control this device (i.e., connect the driver, conduct a readiness poll, or output any errors to a display). A universal synchronous-asynchronous receiver-transmitter receives a byte of information in sequential code and issues it to the single-chip computer. The circuit also contains a clock and synchronization frequency divider for the universal synchronous-asynchronous receiver-transmitter (from 1,200 to 9,600 baud). The controller is also capable of self-testing. The information output program is written in assembler and occupies less than 1 K of memory. The single-chip computer's operating program is translated and debugged in the OS RV operating system by cross

software and may thus be used for specific executions without changing the circuit. Figures 1; references 3: Russian.

Functional Modules of a Measuring and Test System Based on an Elektronika 60 Microcomputer

917G0046O Moscow MIKROPROTSESSORNYYE SREDSTVA I SISTEMY in Russian No 3, May-Jun 90 (manuscript received 13 Nov 87) pp 75-77

[Article by Yu. V. Novikov]

UDC 681.326.74

[Abstract] The functional modules included in the measuring and test system that has been developed on the basis of the Elektronika 60 microcomputer perform a variety of functions. These include the following: generation of control (input) actions; recording of response (output) reactions; time coordination of the operation of individual parts of the measuring and test system; analog-to-digital and digital-to-analog conversion; electric and logic interfacing with the test object; debugging; measurement; and improvement of the basic modules' characteristics, for example, increasing their speed. The system includes the following modules: a logic analyzer that records 1,024 states of 20 input lines with a clock frequency up to 10 MHz, an adapter to increase the logic analyzer module's speed, a module for synchronization based on designated combinations of levels in the lines, buffer modules, an analog-to-digital converter module that works in conjunction with the logic analyzer module to record analog signals, and a module to generate code sequences. These modules are described in detail. Figures 5; references 6: Russian.

A Device for Monitoring the Level of Memory Microcircuits' Output Signals

917G0046P Moscow MIKROPROTSESSORNYYE SREDSTVA I SISTEMY in Russian No 3, May-Jun 90 (manuscript received 1 Aug 88) pp 77-78

[Article by A. A. Bondarenko and V. F. Skorokhodov]

UDC 681.326.3

[Abstract] The reprogrammable read-only memory [RePROM] devices with ultraviolet erasure that are widely used in microprocessor technology have a major shortcoming: The level of the data output signal from the microcircuit's output sometimes turns out to be between Log.0 and Log.1, i.e., between 0.4 and 2.4 V. Existing RePROM microcircuit programmers do not have the capability of monitoring the level of the output signal. Consequently, errors are difficult to detect. The authors of the present article describe a device to monitor the level of the output signals of K573RF2 and K573RF5 memory microcircuits. The new device is intended for operation with a programmer described elsewhere. The new monitoring device requires three parallel output lines and two input lines. It consists of an analog multiplexer and two voltage comparators. This article includes a schematic and description of the new device's components and operation. Figures 2; references 4: Russian.

Menu System for a Personal Computer

917G0046Q Moscow MIKROPROTSESSORNYYE SREDSTVA I SISTEMY in Russian No 3, May-Jun 90 (manuscript received Feb 87) pp 79-80

[Article by A. L. Kovalev, P. V. Krenevich, and S. L. Lizenko]

UDC 681.3.06

[Abstract] The RTK-mikro [robot system-micro] menu system uses a menu-type interface for personal computers; for the Elektronika 60, DVK2, DVK3, and Elektronika 85 microcomputers; and for the SM4 minicomputer in the environment of the RAFOS (or FODOS or OS DVK) operating system. It provides a natural user interface with the system and applications programs via a menu. The menu can issue either: 1) commands to the operating system's monitor, 2) information, or 3) a reference to another menu. Also included in the menu system are a menu editor, a menu interpreter, and a print utility. The menu system makes it possible to create a flexible, problem-oriented interface between user and computer. For five years, the menu system has been used in different organizations to create reference information systems; instructional, archive, and management systems; and systems for preparing and processing documents. The menu system requires 30 kbytes of memory, 5 kbytes of which is used by the menu interpreter. Tables 1.

Organizing a User Interface Based on the RTK-Mikro Menu System

917G0046R Moscow MIKROPROTSESSORNYYE SREDSTVA I SISTEMY in Russian No 3, May-Jun 90 (manuscript received 30 Jan 88) pp 80-81

[Article by V. A. Zimnovich and V. A. Sukhman]

UDC 681.3.06

[Abstract] The RTK-Mikro [robot system-micro] menu system was developed at the Computer Science Institute of the UkSSR Academy of Sciences as part of a robot system intended to perform various tasks on type DVK or Elektronika 85 microcomputers in the environment of the FODOS or RAFOS operating system. The authors of the present article describe their four years of experience in using the RTK-Mikro menu system. Described in detail is the RTK-Mikro menu system's role in managing bibliographic information, developing and processing various documentation, managing a library of algorithms and programs, developing a set of archives,

maintaining software developments, and developing a prototype mobile technological environment. The authors place particular emphasis on the simplicity, "naturalness," flexibility, and standardization of the menu system's interface.

Program Package for Operating an Elektronika BK-0010 Microcomputer With a Printer

917G0046S Moscow MIKROPROTSESSORNYYE SREDSTVA I SISTEMY in Russian No 3, May-Jun 90 (manuscript received 26 May 88) pp 81-82

[Article by D. A. Chernikov and K. A. Chernikov]

UDC 681.3.06

[Abstract] The capabilities of an Elektronika BK-0010 microcomputer may be expanded significantly by connecting it to a printer. The authors of this article have developed a program package that makes it possible to operate the Elektronika BK-0010 microcomputer with a standard thermal printer (with a DVK-2) or with another printer that has an analog interface. The package includes six programs. The DIR/PRI prints a catalog of the files written onto a peripheral carrier. The PRI/FOC:DOC program prints the texts or results of the operation of programs written in FOKAL. The PRI/ED/K program prints files written in the editors EDASP and MIKRO8K or in another analogous format. The PRI/S program prints files written in the MIKRO8S editor or other files with an analogous format. The PRI/MIK program is designed to make a back-up printout of any information output to the display screen, print nonstandard text files, or output any information obtained from the monitor after a program has started (for example, instructions to certain games produced as complete programs rather than in the form of text files). The PRI/BAS program prints six texts or the results of the execution of programs written in BASIC for a BK-0010 with built-in FOKAL. The package can print lines up to 80 characters long and pages up to 64 lines long. The package permits parallel output to a display screen and printer.

Graphics for a Local Area Network of BK-0010 Microcomputers

917G0046T Moscow MIKROPROTSESSORNYYE SREDSTVA I SISTEMY in Russian No 3, May-Jun 90 (manuscript received 20 Jun 88) pp 82-83

[Article by V. L. Lavrovskiy]

UDC 681.322.042

[Abstract] This article describes a local area network that makes it possible to work in Pascal with image-forming elements on an Elektronika BK-0010 microcomputer. An industrial version of the network may be operated without any hardware modifications. Each of the BK-0010 microcomputers in the network includes a monitor program that contains a text editor. It converts the operator's instructions into a translation, loads the source text, and translates the program for the BK-0010 into the respective program queries executed in the central complex. This brief article details selected procedures used to output graphic images in the system.

Single-Chip Display and Keyboard Controller

917G0047A Moscow MIKROPROTSESSORNYYE SREDSTVA I SISTEMY in Russian No 4, Jul-Aug 90 (manuscript received 8 Jun 89) pp 5-9

[Article by Ye. M. Blokh and K. B. Bodashkov]

UDC 681.326.3:681.327.2

[Abstract] The K1809VGZ microcircuit is intended for use in creating cathode ray tube [CRT]-based display devices and for reproducing alphanumeric and graphic information on the screen of a monochrome and color monitor and for inputting data from a keyboard. It overlaps the entire image-forming path from the common bus to the video signals and in so doing occupies several series KR580 LSI circuits. The K1809VG3 display controller has four basic display modes: alphanumeric, graphic, combined (alphanumeric plus graphic), and slide. An internal character generator generates symbols in a matrix of 5 x 7 points. Several forms of representing information are used in the graphic mode. These include a bit map; line pixels with a resolution of 256 x 256, 256 x 128, and 128 x 128; and points and blocks with a resolution of 64 x 64 points. In the bit map mode, each point of an image is coded in a 2-bit code, which makes it possible to represent colors in three primary colors: red, green, and blue. Also provided are detailed discussions of the controller's interfaces with the processor and memory, the internal data buffer, the keyboard, and the video monitor. Figures 3, tables 7; references 3: Russian.

Graphic Coprocessor for Workstations and Personal Computers

917G0047B Moscow MIKROPROTSESSORNYYE SREDSTVA I SISTEMY in Russian No 4, Jul-Aug 90 (manuscript received 23 Mar 89) pp 10-14

[Article by T. T. Paltashev and O. A. Rakhmatulin]

UDC 681.325.5

[Abstract] The i82786 graphic coprocessor is intended for use in the raster terminals of automated design systems and in professional personal computers. The i82786 LSI circuit permits high-speed processing of graphic and text data, makes it possible to combine them during framing operations, displays them in a high-quality manner, and supports a multitasking mode. The microcircuit is based on high-quality CMOS [complementary metal-oxide-semiconductor] technology in a

case that is analogous to an i80286 16-bit microprocessor. The microcircuit has a power consumption of 1 W. The i82786 LSI circuit is distinguished by a weakly connected system architecture that supports a coprocessor mode. Microprocessors ranging from the 16-bit i8086 to a 32-bit i80386 may be used as the central processor. The LSI works with the central processor in driven and driver modes. The i82786 contains four basic modules: a graphic processor, a display processor, bus interfaces, and a video memory. The graphic coprocessor may be used in the format of the monochrome and color adapters of IBM personal computers. The i82786 coprocessor can execute vertical and horizontal movements without any additional external equipment, can magnify with a scale factor up to 64, can simultaneously display up to 1,024 colors, and can support a resolution from 640 x 480 x 8 to 1024 x 1024 x 2 bits with progressive scanning at a frequency up to 60 Hz. It significantly increases the productivity of graphic systems with multitask and polyscreen operating modes. When used with an automated design system, desktop publishing systems, and high-productivity computer, the i82786 graphic coprocessor can effectively support the operation of such multiwindow software as GEM and X-WINDOWS. Figures 2; references 3: Western.

The KR11820VP1 CMOS LSI Circuit—A Peripheral Device for Single-Chip Computers

917G0047C Moscow MIKROPROTSESSORNYYE SREDSTVA I SISTEMY in Russian No 4, Jul-Aug 90 (manuscript received 4 Jul 89) pp 14-16

[Article by A. A. Kutsenko and V. K. Kovalevskiy]

UDC 681.323

[Abstract] The KR11820VP1 microcircuit stores the contents of a computer's RAM when the power is cut off and conditions a special control signal for cyclic cutoff of the power of a single-chip computer when a pause between references to the microcomputer exceeds the specified duration. The LSI circuit is based on complementary metal-oxide-semiconductor [CMOS] technology with a self-aligned polysilicon gate and with insulation of its elements by a thick oxide. It is enclosed in a type 201.14-1, 14-lead plastic case and costs roughly 2.7 rubles. The KR11820VP1 microcircuit has a voltage requirement of 5.0 +/- 10 percen V, has a power requirement of no more than 0.165 W, has an instruction word length of five, can process six instructions, exchanges data with a peripheral device at a speed of 1 Mbyte/s, and has 256 bits of RAM. The KR11820VP1 LSI circuit makes it possible to use a series KR1820 4-bit single-chip microcomputer in control systems with self-contained power supplies, which expands their applications area greatly. Figures 2; tables 2.

Performing Floating-Point Arithmetic and Elementary Functions for Series K1816, K1810, K580, and K1821 Microprocessors

917G0047D Moscow MIKROPROTSESSORNYYE SREDSTVA I SISTEMY in Russian No 4, Jul-Aug 90 (manuscript received 19 Oct 89) pp 16-18

[Article by Yu. M. Rudenko]

UDC 681.3.06:326

[Abstract] This article examines the problem of performing floating-point arithmetic operations and working with elementary functions on series K1816, K1810, K580, and K1821 microprocessors and discusses a program library that has been developed for various enterprises and organizations to use in performing these types of arithmetic operations. The structure of the data used in such computations is described along with programs for performing the operations of addition, subtraction, multiplication, and division. Charts detailing the arrangement of the program modules used to perform the four operations are presented along with a table detailing the times and amounts of memory and data required to execute the programs. All of the elementary functions discussed use the aforementioned arithmetic operations and other complementary functions. Together, they occupy 1 kbyte of memory. The experience accrued during the use of the first version of the library of floating-point arithmetic programs made it possible to reduce the number of modules included in the program library and to add new programs that proved to be necessary. These include programs to computer error functions, Fourier transforms, and gamma-functions. This revision process resulted in a new program library that proved to be portable and convenient to use and expand. The speed of the individual programs in the library was raised an average of an order of magnitude while the amount of memory required by the programs was cut by about half. The library occupies three 5- or 8-inch diskettes. Figures 1; tables 1; references 4: Russian.

BAZA-85 Program Package for Personal Computers

917G0047E Moscow MIKROPROTSESSORNYYE SREDSTVA I SISTEMY in Russian No 4, Jul-Aug 90 (manuscript received 21 Feb 89) pp 20-21

[Article by Ye. Yu. Laktionov]

UDC 681.3.06

[Abstract] The BAZA-85 program package is intended for use by personal computer users who are not professional programmers. It includes rather advanced means for inputting, editing, and retrieving a fair amount of data (on the order of a thousand or tens of thousands of records). The data base is a set of relational expressions in one file system catalogue. These relational expressions

are organized in the form of a rectangular data table; columns, headings, and data fields constitute the elements of these relational expressions. The types of data possible are whole and real numbers (binary precision) and text (up to 256 characters). The package functions in conjunction with a hard disk; floppy disks are used to copy and store relational expressions. Up to 400 kbytes of relational expressions and up to 32,000 records are possible. A record can be up to 2 kbytes long and can contain up to 32 fields. The number of relational expressions possible in the data base is limited solely by the capacity of the hard disk. The package screen contains the following regions: a package menu, a working region, and status, editing, and message lines. The working region is a window to the active relational expression. The editing line serves to input data and instructions, and the message line displays explanations and warnings. Data are input and edited in a screen editing mode. The sort key may contain up to five record relational expression fields. The following are among the retrieval and sampling operations that may be performed using the BAZA-85 program package: sampling and elimination of records, creation of a new column or field, and computation of aggregate functions (sum, mean, maximum, or minimum). The BAZA-85 program package can export data to the TABLITSA-85 package. The BAZA-85 is supplied with a library containing functions for working with relational expressions. The user can use this library to develop his own program data-compatible relational expressions in the programming language C. The BAZA-85 package operates on an Elektronika MS0585 personal computer with the INMOS-85 operating system (version 1.2 or higher). The package is furnished with a library of algorithms and programs from the Berdyansk Division of the Institute of Information Science Problems of the USSR Academy of Sciences.

Organizing the User Software Environment of a PC-Based Research Automation System

917G0047F Moscow MIKROPROTSESSORNYYE SREDSTVA I SISTEMY in Russian No 4, Jul-Aug 90 (manuscript received 8 Feb 89) pp 21-24

[Article by S. N. Domaratskiy and I. L. Shrago]

UDC 681.32.06

[Abstract] The capabilities of modern personal computers are making it possible to achieve a new level of quality in scientific research automation systems. Because advances in the quality level of the hardware used in such systems are proceeding markedly more slowly than are advances in computer technology in general, most of the improvements in scientific research automation systems will come from advances in the area of increasing the depth of experimental data processing on personal computers and designing expert systems. Of special importance are the processes of interaction with the researcher and the selection of alternatives. This article discusses the methods and practical results of a project to develop an interactive program environment for scientific automation on the Iskra-1030 personal computer and other analogues of the IBM PC XT. The environment developed is based on the use of a batch supervisor with a hierarchical structure. The standard structure of a scientific research automation package is used along with the concept of a user interface. This makes it possible for users to use prepared programs (regardless of the language in which they have been written) and to improve the quality of working with original software having an obsolete user interface. Multilevel interactive program packages are compiled from previously developed executive (.EXE) files in any language; no changes in the source code are required. The program developed (it is called Formirovatel derevyev [tree former]) was used to create a series of simple, convenient-to-use packages for different subject areas. It is intended for use in the ADOS 3.3 operating environment on the Iskra-1030 but can also be used on IBM PCs with the MS DOS operating system. It occupies 29 kbytes on diskette and 32 kbytes of the personal computer's RAM. Figures 4; references 3: 2 Russian, 1 Western.

Organizing Software for Floppy Disk Controllers

917G0047G Moscow MIKROPROTSESSORNYYE SREDSTVA I SISTEMY in Russian No 4, Jul-Aug 90 (manuscript received 16 Feb 88) pp 26-30

[Article by N. N. Shchelkunov and A. P. Dianov]

UDC 681.3

[Abstract] This article describes the mDISK package, which is the foundation of the basic I/O system [BIOS] of the new mMS1207 single-board microcomputer, which is compatible with the DOS1810 file system. The mDISK software is intended for use with an mMS5301 virtual 6-chip controller for single- and double-density floppy diskettes based on the i8272A LSI circuit and geared toward type mMS systems. The mDISK package provides a good compromise between the needs of systems and applied programmers on the one hand, and the capabilities of a floppy disk controller on the other. The software for the floppy disk controller is designed in the form of a multilevel system of virtual devices with distinctly defined program interfaces. This article details the design and operation of the floppy disk controller's system interface, the block describing the physical devices, and the program interface of the external memory's physical devices. Figures 4; tables 5; references 4: Russian.

Compact Statistics System for IBM-Type Personal Computers

917G0047H Moscow MIKROPROTSESSORNYYE SREDSTVA I SISTEMY in Russian No 4, Jul-Aug 90 (manuscript received 2 Dec 88) pp 31-33

[Article by A. P. Kulaichev]

UDC 681.3.06

[Abstract] Using statistical methods to process data is an indispensable part of any research activity, and the

accessibility of this type of software is increasing as personal computers become more popular. Even among foreign software, however, there do not appear to be any good statistics systems for the average user. Rather, most of the good systems are geared toward highly qualified specialists, and most contain a broad spectrum of statistical methods and modifications that are intended for special applications. The compact and easy-to-reference programs that do exist (such as MICROSTAT and STATPAC) do not permit graphic display of data and results, and their interactive capabilities are far from meeting modern requirements. Even such ergonomic systems as STATGRAPHICS, which have wonderful graphics and interaction, are very complicated in many respects and are not suitable for the average user. Moreover, most foreign statistics systems for IBM PCs are difficult to adapt to the Iskra 1030 or Neuron I9 owing to technical constraints and differences. The STATIS statistics system, which operates on IBM-type personal computers, fills the existing gap in statistics systems in many respects. It features the following: widely used statistical methods and estimates; a convenient and simple system of menus, prompts, and instructions that can each be used with single keystrokes; well-developed graphic display of data and results with the capability of quick output to a color or black-and-white monitor or printer; and the capability of rapid transition from data manipulation to statistical processing and graphic output. The STATIS system is compact and simple to operate. It is based on several samples and matrices with up to 100 elements each, and it includes a built-in data editor and file system and is adaptable to the most popular types of video controllers. Data may be input from a keyboard or from numerical and/or text files. Results can be output to a screen or printer in numerical or graphic form or to a disk file in text form. The system's interactive infrastructure meets the most modern international standards in this field. The key characteristics of the STATIS system are compared with those of selected Western statistics systems (BMDP, SYSTAT, STATGRAPHICS, SPSS, MICROSTAT, and STATPAC) and are summarized in table form. Tables 2; references 6: Western.

Software Tools for the KB1013 Single-Chip Computer

917G0047I Moscow MIKROPROTSESSORNYYE SREDSTVA I SISTEMY in Russian No 4, Jul-Aug 90 (manuscript received 22 Mar 89) pp 37-38

[Article by A. S. Gaganov, V. P. Anishchenko, S. A. Morozov, and A. D. Cherkay]

UDC 681.3.06

[Abstract] The wide-scale introduction of 4-bit single-chip computers into the economy has made it possible to develop new consumer technology and electronic games for use in teaching children, create comfortable conditions while conserving electric power, and increase the range of available consumer goods. As the numbers of such single-chip computers has increased, so too has the demand for software for them. This article describes a set of software tools that has been developed for use with the KB1013 series of single-chip computers. The process of developing software for the KB1013 computer series entails the following steps: creating a model of the liquid crystal display if the algorithm of the software being developed calls for output to the display, preparing and translating the program's source text, debugging the program based on a logic model of the program, and preparation of a source text of the program for a musical read-only memory [ROM]. The source text of a program being developed may be created by any operating system text editor and is processed by a translator. It consists of assembler commands, machine instructions, and commentaries. Processing by the translator results in the following files: a listing with ROM addresses and error messages, user program object codes to formulate the control magnetic tape, and an image of the ROM for the logic program model. The programs are debugged in an interactive mode on the basis of a logic model of the program that reflects the architecture and instruction system of the series KB1013 single-chip computer. Special design methods used in the software tools package permit close-to-real-time simulation of the program undergoing debugging. Another program is provided to load the debugged user program into the ROM of a specific single-chip computer. A musical automaton is also provided to program a melody in the range of two octaves. A text editor then prepares this file for a musical ROM. The new software tools also include a package of arithmetic programs to perform basic floating-point arithmetic operations; the arithmetic programs do not occupy more than nine pages of 63 words each. The tools described, which consist of an assembler, reassembler, logic program model, and programs to prepare a control magnetic tape, are well recommended for use in creating electronic games.

The POMpA Cross-System Family

917G0047J Moscow MIKROPROTSESSORNYYE SREDSTVA I SISTEMY in Russian No 4, Jul-Aug 90 (manuscript received 13 Mar 89) pp 39-42

[Article by V. N. Balmich, G. V. Kroychik, S. M. Krol, O. G. Paliy, and R. V. Felezyuk]

UDC 681.3.06

[Abstract] The POMpA family of interactive adaptive automated design cross-systems is a component of the Prometey [Prometheus] technology for designing software products throughout all stages of their life cycle. The cross-systems included in the family are a functional series and may be adjusted for specific types of target computers. Versions of the systems have been developed

for different development computers, including the SM4, SM1420, and Elektronika MSO585 personal computer. Besides conventional means for translating, configuring, and debugging programs, the POMpA cross-systems also include means for managing design data bases and monitoring the course of the development, have a wide range of utilities, and incorporate a subsystem to issue text documentation in accordance with the Unified System of Design Documentation and YeSPD [Unified Document Preparation System]. The POMpA system makes it possible to develop and expand the makeup of software development tools. It operates independently of any specific operating system. The system is based on a method calling for the creation of a virtual interface to use the system functions of the operating system and data base manager in development software. In the program development stage, this virtual interface is supported by a set of standard procedures from the POMpA system's library. The contents of this library and all of the system's data structures are described in accompanying documentation, which makes it possible to develop programs in Macro 11 or Pascal for subsequent execution within the framework of the system. While working with the POMpA, the user may use any instruction or program of the OS RV operating system. The technological process entailed in using the POMpA system for design is discussed in detail. Development of the POMpA family of cross-systems is continuing; new versions are being developed for use with additional types of computers, including the SM1700. Figures 1; references 5: Russian.

A Control Program for the GAMMA-5 Intelligent Graphic Terminal

917G0047K Moscow MIKROPROTSESSORNYYE SREDSTVA I SISTEMY in Russian No 4, Jul-Aug 90 (manuscript received 19 Oct 88) pp 45-47

[Article by M. G. Bryzgalova and P. V. Veltmander]

UDC 681.3.01

[Abstract] The GAMMA-5 intelligent graphic terminal was developed as a component of a system for "mass" interactive computer graphics that would bring graphic I/O to the mass user's workstation. The display is a single-board microcomputer (graphic controller) that can be inserted in a free mounting site of any type α YeS7168 alphanumeric display. The main objective in designing the GAMMA-5 was to give it sufficient capabilities for uncomplicated applications. The first half of this article outlines the GAMMA-5 graphic terminal's capabilities and the architecture of its graphic controller. The second half deals with the control program that has been developed for the GAMMA-5 display. This control program is divided into three logical levels: processing interrupts, interpreting the input buffer, and interpreting the graphic buffer. The first level supports the function of data input from the display and from a computer. The modules at this level have the highest priority and serve to read incoming data and load them into the input buffer. The program of the second logical level is executed as a background program for the operations performed at the first level, and the third logical level serves as a background for the operation of the first two. Together, the programs at the first two levels perform a transport function: They send data back and forth between the display and computer. The control program includes a control block, a graphic input block, a block to output broken lines, and a block to output graphic text. The specific execution of the control program protocol includes 45 instructions. Each consists of an operation code and data. KOI-7 coding is used. The control program described has been debugged and introduced at a number of organizations. Figures 1; references 8: Russian.

Using a Shtrikh Fax Device to Input Images Into a Microcomputer

917G0047L Moscow MIKROPROTSESSORNYYE SREDSTVA I SISTEMY in Russian No 4, Jul-Aug 90 (manuscript received 6 May 88) pp 48-50

[Article by E. E. Dvorskiy, A. N. Chernyakhovskiy, and M. M. Leznikh]

UDC 681.327.12:621.397.7

[Abstract] The Shtrikh fax device has become the most popular fax device in the country. The scanner developed on its basis has a number of important advantages. These include the capability of changing the resolution of horizontal scanning, controlled feed along the vertical with quick change of the feed increment, high linearity and strict horizontality of line scanning, the possibility of continuous or discrete control of the contrast of the information being read, and selection of scanning speed. The Shtrikh fax device produces black-and-white images at scanning speeds of 120 and 240 rpm. It uses the method of drum scanning in a leftward direction. It has a scanning increment of 0.259 millimeters per rotation and a resolution of 3.8 lines per millimeter. The Shtrikh fax device can scan originals with a minimal analyzable line thickness of 0.1 mm and can send a form with dimensions not exceeding 210 x 297 mm. It has a useful write field of 193 x 277 mm, operates at a voltage of 127 or 220 V, and has a power consumption of no more than 110 W. A graphic information input system based on the Shtrikh fax device has been used to develop a prototype of a reading automaton for communications terminals. It scans machine- and hand-written text documents with a resolution of 0.13 mm along the horizontal and 0.19 mm along the vertical. The fax device can also be used as a high-resolution scanning printer and to organize information transmission along communications channels with subsequent input into a microcomputer. Figures 3; references 3: Russian.

A Microprocessor System for Design and Debugging of Microcontrollers

917G0047M Moscow MIKROPROTSESSORNYYE SREDSTVA I SISTEMY in Russian No 4, Jul-Aug 90 (manuscript received 21 Mar 89) pp 52-53

[Article by S. A. Nesterenko and V. A. Kravtsov]

UDC 681.326

[Abstract] This article describes a microprocessor system that is intended to design and debug microcontrollers based on single-chip computers in the K1816 series. The new system makes it possible to debug a controller's software and hardware as well as perform the finishing debugging of a device being designed. Along with a base personal computer, the system includes a debugging module, a programmer, and an in-circuit emulator unit. These modules may be made resident in a DVK2M personal computer. The system's software supports its hardware along with self-contained development of software of the controller being designed, and it gives users a convenient interface for interacting with the device being developed. The software system includes a programming cross-system, a debugging program, and programs to support the process of programming the read-only memory and in-circuit emulation. The debugging program permits the following: loading from disk into the personal computer's memory; copying from the personal computer's memory into RAM; activation of a program loaded into the RAM of the processor nucleus for execution from any address; establishment of a stop address, step-by-step execution of an instruction with display of the result on the personal computer's display terminal; disassembly of a program written into the personal computer's memory; scanning and revision of the contents of the internal elements of the single-chip computer; scanning and revision of the contents of the RAM of programs in the form of mnemonic codes of instructions and in hexadecimal form; copying of a debugged program from the personal computer's memory to disk and to an alphanumeric printer; and diagnosis of the hardware components of the processor nucleus and optional board. The programming cross-system includes a screen editor, cross-assembler, and MIKROS assembler. The software and hardware system described is an intelligent design system to automate the development of controllers based on series K1816 single-chip computers. Figures 3; references 4: Russian.

A Debugging Panel for Devices Based on Single-Chip Computers

917G0047N Moscow MIKROPROTSESSORNYYE SREDSTVA I SISTEMY in Russian No 4, Jul-Aug 90 (manuscript received 13 Apr 89) pp 53-55

[Article by A. V. Bedarev and V. S. Gravov]

UDC 681.326

[Abstract] This article describes a debugging panel that is intended for use in checking the operation of devices based on the KR1816VYe35, KM1816VYe48, AND KM181VYe49 single-chip computers. The debugging panel makes it possible to switch a device (while it is in operation) from a mode of continuous program execution to one of instruction-by-instruction execution and vice versa or to stop the execution of a program at a specified address. The debugging panel allows users to check the operation of any device based on a single-chip computer with a real program that has been written into the external program memory. The debugging panel may be connected to the device to be checked by clips applied to the single-chip computer's LSI circuit or by another connection attached directly to the single-chip computer's leads, provided the device to be checked has such a connection. The panel establishes information that is actually present in the leads of the data bus leads, the low-order portion of port P2, and the single-chip computer's control signals in each instruction cycle. This information is very valuable when debugging a device. Unlike the OU-48 and OU-49 debugging devices, which are mainly intended to debug software and the in-circuit emulation of a single-chip computer, the new debugging panel is capable of detecting and locating hardware faults. This includes faults in those portions of a device that are not checked or not used during operation of the OU-48 and OU-49. The new panel is thus a successful complement to existing hardware for developing and servicing devices based on single-chip computers. The debugging panel stores information collected at specified moments during the execution of an instruction. After execution of that instruction has been completed, the information is reproduced on the panel's indicators in a form that is convenient for the operator to understand. The panel has one external 5-V power source with a current up to 2 A. It is based on 33 series K155, K555, K556, and K589 microcircuits; 13 light-emitting matrix diodes; and 9 discrete light-emitting diodes. The new debugging panel has been manufactured and used for two years at the Department of Computer and Information and Measurement Technology at the Moscow Oil and Gas Institute imeni I. M. Gubkin. Figures 2.

A Testing and Debugging System for Series K1816 Single-Chip Computers

917G0047O Moscow MIKROPROTSESSORNYYE SREDSTVA I SISTEMY in Russian No 4, Jul-Aug 90 (manuscript received 25 Apr 89) pp 55-57

[Article by Yu. M. Rudenko, V. G. Zhiganov, and A. Ya. Mosin]

UDC 681.3.06:326

[Abstract] This article describes a new testing and debugging system for K1816VYe48 and KM1816VYe035 single-chip computers. The new system is intended to check the correctness of the execution of instructions and to

debug programs in a real prototype. Programs are represented in the form of absolute codes that may be produced and debugged at the logic level in advance by using cross-tools such as the MIKROSS 048. The new testing and debugging system has been developed for the DVK2, 3, and 4 or for the Elektronika 60 microcomputer. It consists of a debugging device and a set of test programs. The RAM may be accessed from the DVK2 or from the single-chip computer. An MS2 multiplexer switches the memory control signals. The set of test programs includes a control program, a start program loader that specifies the basic instruction set needed to write a test, a testing program, and a program to analyze and output the test results to a printer or display screen. The testing program occupies a maximum of 1.4 kbytes of ROM and executes programs in a single-chip computer in about three seconds. The debugging device has been manufactured in the form of a standard half-board of the DVK2 design. When used to debug this system, the new debugging device detected errors in the logical program model simulating execution of RETR and JMPP instructions. The new system has been tested on real prototypes and has helped detect an inoperative JMPP instruction. The system is extremely effective when used to check the serviceability of series- and mass-produced single-chip computers as well as instruments and devices that include a single-chip computer as a control element. Figures 2; references 3: Russian.

A Hardware-Software Debugging System Based on an Elektronika MS 2702-1 Controller

917G0047P Moscow MIKROPROTSESSORNYYE SREDSTVA I SISTEMY in Russian No 4, Jul-Aug 90 (manuscript received 17 Oct 88) pp 57-59

[Article by V. S. Semenov, S. G. Shipilov, Ye. A. Safronov, and O. A. Zinoveykin]

UDC 681.327.2

[Abstract] A large variety of hardware-software debugging systems based on microprocessors with a fixed instruction system currently exists. These include estimation modules with a limited capacity, advanced systems, and general purpose systems. The hardware-software debugging system described in this article is based on the principle of a direct microprocessor link. The organization of the direct link channel permits the transfer of files from a time-share system to the controller's memory. The system is based on an Elektronika MS 2702-1 controller. This controller is a single-board microcomputer manufactured on the basis of a KR580 LSI circuit microprocessor complex and is intended to control various manufacturing equipment. The complex can work alone or in a link with a higher-level computer. The hardware-software debugging system described includes a 15VUMS028-25 computer that is linked by means of a serial interface to an Elektronika MS 2702-1 controller that is in turn linked by a serial interface to a video terminal. The system software includes a monitor (2 kbytes) located in the read-only memory. This monitor makes it possible to check and/or revise the contents of the RAM or microprocessor registers, load a program (data) into RAM manually (offline) or from a higher-level computer, and execute a program with or without using interruption points. To function in its basic mode, the monitor requires an Elektronika MS 2702-1 controller and alphanumeric display. To function while linked to a higher-level computer, it requires an external minicomputer or microcomputer. Both an assembler and a higher-level language may be used to translate the source texts of programs. The system may be supplemented with an in-circuit emulator, which expands its capabilities significantly. Figures 2; references 6: Russian.

Debugging Tool Set

917G0047Q Moscow MIKROPROTSESSORNYYE SREDSTVA I SISTEMY in Russian No 4, Jul-Aug 90 (manuscript received 11 Nov 88) pp 59-60

[Article by S. S. Selitskiy and M. Yu. Syrkin]

UDC 681.3.06

[Abstract] The debugging system of a K1816VYe48 single-chip computer consists of an SM1800 development computer and an OU-48 in-circuit emulator operating in an online (duplex link) mode. To provide their new debugging software with a closed-loop debugging cycle, the authors developed a package of cross-software for the K1816VYe48 single-chip computer. In includes the following components: a DEB48 cross-debugger that is intended for offline program debugging and that may be supplied for any development computer with a CP/M-compatible operating system; the IOU48 program, which is intended to work with the OU-48 debugging device in a remote control mode; and a program to output a hexadecimal file to punch tape in a memory display format (for subsequent burning into ROM). The XASM48 cross-assembler (produced by UVOCET SYSTEM) may be used to prepare programs for the single-chip computer. The DEB48 and IOU48 programs have an identical user interface; however, one works with the program being debugged in a mode of pure software emulation of a K1816VYe48 microcomputer, while the other works in an online mode with a special OU-48 device. A standard IRPR SM1800 module with a slight hardware modification is used to make the SM1800 microcomputer and OU-48 compatible. The instruction menu of the DEB48 and IOU48 programs is the standard menu for this class of systems. The cross-debugger, however, is unique in that it permits program editing in mnemonic form by using a built-in assembler and disassembler. Unlike existing debugging systems and cross-systems that operate under the RAFOS, DVK, RV, or DOS1800 operating systems, the DEB48 + IOU48 program system operates in the environment of the CP/M operating system, which gives the system a number of additional capabilities. These include the

following: the ability to use the powerful CP/M screen editor in working with text, the ability to debug the basic logic of a program in an emulation mode and in real-time mode, the ability to store results on disk in hexadecimal format, and the ability to output a program to punch tape for subsequent burning into ROM or to translate it directly into the reprogrammable ROM [RePROM] of a single-chip computer by using the OU-48 programmer. The shortcoming of the tool system is that it does not permit the configuration of a program from previously translated modules. Figures 1, tables 1; references 2: Russian.

Parallel I/O Module

917G0047R Moscow MIKROPROTSESSORNYYE SREDSTVA I SISTEMY in Russian No 4, Jul-Aug 90 (manuscript received 23 May 88) pp 68-69

[Article by Ye. M. Alekseyeva, E. S. Kriveleva, and I. V. Fleyshman]

UDC 681.327.8.06

[Abstract] This article describes a parallel I/O module that is designed to exchange information in the form of hexadecimal binary code between a computer and an Elektronika MS 1201.02 microcomputer. The parallel I/O module consists of a device to control information I/O and to control information transmission. A K1801VP1-033 LSI circuit functions as the control device. Data are transmitted by four K1801VP1-033 LSI circuits. The standard circuit for connected K1801VP1-033 LSI circuits in an information transmission mode makes it possible to input 20 binary signals and output 16. In the module described, the number of I/O signals has been increased to 32 owing to a somewhat nonstandard method of connecting the LSI circuits as well as to the use of additional registers based on K1801VP1-033 LSI circuits and connected in a buffer mode. For microcomputers, the module is provided with three separate registers that are accessible by software for reading and writing. The number of binary signals may be increased to 44 by using the free bits of the control device's state register and an additional information output register. This article details the circuitry of the new parallel I/O module as well as the method by which it sends information from a computer to a microcomputer. Figures 1; references 1: Russian.

Interfaces With an MPI Bus Based on Series K1802 LSI Circuits

917G0047S Moscow MIKROPROTSESSORNYYE SREDSTVA I SISTEMY in Russian No 4, Jul-Aug 90 (manuscript received 20 Jun 88) pp 75-77

[Article by Yu. A. Bunyak]

UDC 681.327

[Abstract] The MPI interface is used in the very popular Elektronika 60 and DVK microcomputers and in microcontrollers based on series K581, K588, K1801, and K1806 microprocessor complexes. To be able to connect peripherals to the channel of the microcomputer's central processor, it is first necessary to adapt the processes of data exchange by using the MPI [microprocessor interface] protocol. This is accomplished by using interface modules. This article details the structure and operation of (1) an interface based on the KR1802VV1 LSI circuit and (2) a multifunctional interface device based on a KR1802VV1 data exchange LSI circuit and a KR1802VV2 interface control LSI circuit. Logic diagrams of each are provided. The two logic diagrams examined represent two possible versions of using the KR1802VV1 data exchange LSI circuit to interface a microcomputer with peripherals. The combined use of data exchange and interface control LSI circuits makes it possible to implement a multifunctional interface with two or three independent data exchange channels. Figures 2; references 5: Russian.

Interfacing an Elektronika 60 Microcomputer With Microprocessors

917G0047T Moscow MIKROPROTSESSORNYYE SREDSTVA I SISTEMY in Russian No 4, Jul-Aug 90 (manuscript received 15 Jul 88) pp 77-78

[Article by G. B. German, A. A. Sachuk, and A. A. Ulybin]

UDC 681.32

[Abstract] When radio engineering systems are created, it is often necessary to interface series-produced commercial devices and newly developed devices for a given system. Because of differences in their signals and time diagrams, such devices cannot operate jointly without special units. This article describes one such interface that may be used to organize the software exchange of data in a system. The proposed interface is distinguished by the simplicity and reliability of its operation. Bus conditioners amplify the signal of the data address and control buses and send information a distance of up to 10 m. They are based on type K559IPZ microcircuits. The interface also features a decoder that is based on a read-only memory and D-triggers. A commutator feeds information from the data registers or from the computer's state register to the computer's common bus in accordance with the address of the register selected. It is based on type K530KP11 microcircuits. Information exchange is accomplished by four 8-bit registers. These are described in detail along with the interface's hardware and software signals. The interface device described has been manufactured and used in a microprocessor control computer system. The central computer provided bilateral information exchanges with computer microprocessors at a speed on the order of 10 kbyte/s. The total length of the cables of the common bus

between the computers was 7.5 m. The signals of the common bus were matched from both ends. To increase the interface's operating reliability, software methods were used to increase the accuracy of the information sent by counting bytes and the check sum of the messages as well as by using a method of repeating the exchange three times when random soft failures were detected in the bundles of control signals. Figures 4; tables 1; references 4: Russian.

An Interface for Control and Automatic Measurement Based on IBM PC XT/AT-Type Personal Computers

917G0047U Moscow MIKROPROTSESSORNYYE SREDSTVA I SISTEMY in Russian No 4, Jul-Aug 90 (manuscript received 16 Jun 89) pp 79-80

[Article by Sh. Biri, A. A. Yefremov, and I. Molnar]

UDC 681.327

[Abstract] In many cases, the creation of different instruments and units requires that the distribution of real physical quantities (such as an electric or magnetic field or temperature) be measured and that these quantities be compared with calculated values. Using the popular IBM PC XT/AT personal computers for such purposes opens up new possibilities with respect to automating measurements; processing data files; and interpreting, storing, and documenting measurement results. The current generation of traditional measurement instruments has standard interfaces (RS-232C, IEEE-488, and HP-1B) connected to computers for remote control and data exchanges. Measurement systems also need to extract and process signals from different sensors, however. This includes signals that control the automatic movement of detectors. This article examines a measurement system based on an IBM PC XT/AT personal computer that is intended for use in measuring a constant magnetic field and processing and documenting the measurement data. The interface used in the new system links the IBM PC XT/AT and a millivoltmeter such as the Shch413. This interface also receives external signals through an 8-bit input and controls various external elements (relays, motors) through an 8-bit power output by using the respective control program. The interface in question includes basic microcircuits to perform the following basic functions: transfer data, decode functions, control initialization, input and output signals, gate signals, clear registers, and check the status of registers. This article diagrams and describes the workings of the new interface and the control program developed to service the interface. The authors note that the hardware capabilities of the new interface are even more extensive than those realized in the control program presented. The new interface can, for example, organize a priority for interrupts when several input signals are received simultaneously. Figures 2; references 4: 2 Russian, 2 Western.

RS232C Programmable Interface for Elektronika 60 Microcomputers

917G0047V Moscow MIKROPROTSESSORNYYE SREDSTVA I SISTEMY in Russian No 4, Jul-Aug 90 (manuscript received 17 Aug 89) pp 80-82

[Article by A. A. Usolkin and N. N. Soroko]

UDC 681.325.5

[Abstract] This article describes the RS232C programmable interface for RS232C microcomputers. It may be used to interface an MPI [microprocessor interface] bus with many domestic and foreign devices and systems having an output to an RS232C. This interface may be used to connect an Elektronika 60 microcomputer to a modem and thus create distributed control systems and regionally distributed computer networks. The interface described may also be used as an IRPS [serial port interface] interface provided that the KR580VV51A universal synchronous-asynchronous receiver-transmitter is programmed for asynchronous data transmission and the receiver's lead is connected to the photo-coupled pairs by the respective jumper. The new interface has a clock frequency of 4608 Hz. When used as an IRPS interface, it has a maximum transmission rate of 38,400 baud and can be used with a communications line up to 500 m long. When used as an RS232C interface, it has a maximum transmission rate of 19,200 baud and can be used with a communications line up to 15 m long. The interface module includes the following components: bus drivers, an address comparator, an automaton for interrupts, a universal synchronous-asynchronous receiver-transmitter, a clock pulse generator, a frequency synchronization unit, a unit to sample internal and external synchronization, a mode register, level converters, and an optronic isolation. The module is implemented on a printed circuit board with dimensions of 252 x 143 x 12 mm in the standard of the Elektronika 60 microcomputer. The new interface's components and their functions are outlined. A detailed diagram is also provided. Figures 1; tables 2.

ROM Emulator

917G0047W Moscow MIKROPROTSESSORNYYE SREDSTVA I SISTEMY in Russian No 4, Jul-Aug 90 p 93

[Article by A. S. Baranov, V. D. Bezgura, and N. A. Perepelitsa]

UDC 681.326

[Abstract] One way of debugging the software and hardware of built-in microprocessor modules operating on the basis of programs written into read-only memory [ROM] is to use a ROM emulator together with a logic analyzer. This brief article describes a ROM emulator that is based on a two-port high-speed random-access memory [RAM] (32K). The RAM is in the form of four

lines, each containing eight KM132RU5A integrated circuits and a RAM for flags (8K x 2). From a design standpoint, the emulator has been manufactured in the form of two printed circuit boards connected to a bus that is logically compatible with an I41. The components and operation of the new emulator are diagrammed and described. The cross-assemblers and loading routine that have been developed for use with the emulator (all of which operate in the MIKRODOS operating system) are also noted. Figures 1.

Channeling Equipment for Sending Digital Signals in Automated Control Systems

917G0051A Kiev MEKHANIZATSIYA I AVTOMATIZATSIYA UPRAVLENIYA: NAUCHNO-PROIZVODSTVENNYY SBORNIK in Russian No 4, Oct-Dec 90 (manuscript received 15 Mar 90) pp 20-24

[Article by I. S. Usov, candidate of technical sciences]

UDC 621.394.42:621.394.74

[Abstract] The USSR Ministry of Communications has derived a series of channels that may be used to send digital signals in automated control systems. Above all, this applies to channels with transmission rates of 50, 100, and 200 (300) baud, which are the standard channels of the Unified Automated System of Communications for the USSR and are widely used for telegraph communications and low-speed data transmission. By using domestically produced digital signal transmission equipment it has been possible for the USSR to create a system of digital transmission channels with the specified speeds throughout all its segments (trunk, zone, city) and to bring these channels directly to where the user is located. Work is currently in progress to establish a system of digital channels with speeds above 300 baud, i.e., from 2.4 to 48 kbyte/s. The USSR has also begun producing equipment with time-sharing of channels, namely, the TVR system. Work is underway to develop and produce equipment conforming to a series of International Consultative Committee on Telegraphy and Telephony [ICCTT] recommendations. Included among these new developments is equipment permitting time-sharing of channels with a group data transmission rate of 2,400 bit/s. This new equipment will make it possible to derive 46 code-dependent telegraph channels in a voice-frequency channel with a frequency band of 0.3 to 3.4 kHz that will permit signal transmission in MTK-2 code at a rate of 50 baud. Another new development conforming to ICCTT recommendations is geared toward a group transmission rate of 4,800 bit/s and will permit the derivation of a doubled number of code-dependent and code-independent channels with transmission speeds of 50, 100, and 200 baud. Another new group data transmission system will make it possible to transmit signals at a rate of 50 baud in MTK-2 code from 120 users (instead of from 45 users as is possible with equipment currently in use). One area where the USSR has not yet developed equipment conforming to ICCTT recommendations is that of deriving basic digital channels with a capacity of 64-kbit/s (as used in Great Britain's Telex system). The use of such equipment in the USSR is problematic inasmuch as such large groups of channels are not required. Plans have, however, been formulated to use digital paths with a lesser capacity (8 kbit/s) in most rural telegraph equipment. The appearance of 64-kbit/s basic digital channels has raised the issue of their combined use by different users, and the matter of how to best use them in the USSR is not being examined. The Kiev department of the Central Scientific Research Institute of Communications has, for example, developed a concept for making optimal use of basic digital channels to transmit digital signals. The proposal calls for using the unified structure of a group signal loop to derive channels to transmit isochronous signals with speeds from 2.4 to 48 kbit/s and asynchronous telegraph signals with speeds from 50 to 300 bit/s. The fact that the signals are to be transmitted in the form of converters will afford a number of advantages, including the capability of using channels in switched data transmission systems and the possibility of deriving remote loop circuits from user to user on a channel-by-channel basis. Using this new equipment will make it possible to switch over to a scheme with a one- and two-stage hierarchy, thereby eliminating the need for five or six types of equipment including that in a two- or three-stage hierarchy. The expected savings from introducing the combined equipment described will be about 35,000 rubles. References 4: 2 Russian, 2 Western.

Kontrast Equipment for Automated Monitoring of Primary Network Path

917G0051B Kiev MEKHANIZATSIYA I AVTOMATIZATSIYA UPRAVLENIYA: NAUCHNO-PROIZVODSTVENNYY SBORNIK in Russian No 4, Oct-Dec 90 (manuscript received 15 Mar 90) pp 24-27

[Article by N. V. Kiyanitsa, V. V. Tsytron, and G. P. Chernyy and D. V. Volovik, candidate of technical sciences]

UDC 621.393.82:621.394.654

[Abstract] An automated operating system entailing the wide-scale use of computer and microprocessor technology is currently being created in the primary bus communications network. One of the main tasks in this undertaking is that of automating the processes of monitoring and backing up network paths. This task is being accomplished by using hardware that makes it possible to accelerate the process of sequentially connecting the existing receiver of a pilot channel to a specified group of network paths, condition signals indicating the status of the paths based on the deviation of the level of the pilot frequency from the rated value, and send these signals through a collection device to a combination maintenance center/information-final control point for subsequent processing and use in the maintenance and control

system. This equipment includes series-produced hardware such as a FOKUS unit and multiplexer, which are being used successfully mainly in low-capacity network nodes. The Kontrast equipment set has been developed to automatically monitor primary network paths. It is sequentially and periodically connected to the network paths of a multichannel device that simultaneously isolates pilot signals from the signals of a specified group of paths, estimates the change in levels of these signals in accordance with accepted criteria, stores the estimation results in its RAM, and issues them upon receiving a request from the maintenance center/information and final control point. These functions are all executed automatically in accordance with a microprocessor program. The Kontrast equipment set consists of two functionally connected parts: a set of controlled path switches located in the existing bays switching the primary group paths and a bay that monitors the network paths. The controlled switches can multiplex 50 paths while feeding signals to a common output. When interacting with a Kontur system, the Kontrast can exchange information at a rate of 9,600 bit/s. The Kontrast equipment set is available in versions with 100, 200, 300, and 400 paths depending on the number of paths to be monitored. Four seconds is required for periodic polling of the status of all paths being monitored. The path switches are designed in the form of printed circuit boards that can fit in existing primary group path switching bays. The Kontrast equipment has been developed for use with the modern component base and KR 580 microprocessor set. The annual savings from introducing one Kontrast equipment set in network nodes and stations of the primary network will amount to 2,500 rubles. Figures 2.

Device to Continuously Monitor the Loading of Transmission Paths in an Automated Operating System

917G0051C Kiev MEKHANIZATSIYA I AVTOMATIZATSIYA UPRAVLENIYA: NAUCHNO-PROIZVODSTVENNYY SBORNIK in Russian No 4, Oct-Dec 90 (manuscript received 6 Apr 90) pp 27-30

[Article by V. T. Fomkin]

UDC 621.391.233:519.25

[Abstract] One effective way of improving the reliability and quality of the Unified Automated System of Communications for the USSR is to create an automated operating system for the primary bus network. The first step in creating an automated operating system for the line equipment shops of individual nodes and exchanges of the primary network is to select the specific system configuration to be used. This decision hinges mainly on the set of tasks to be automated, which in turn depends on the purpose of the line equipment shop and the number of objects that must be monitored. Automation practice shows that, for a variety of reasons, the single-computer automated monitoring system that is usually recommended will not be very effective when objects to be monitored number more than 2,000 (which is the case about a fourth of the time). One possible way of increasing the effectiveness of automated monitoring systems of line equipment shops is to have a computer that is separate from the main control computer system perform those operations-type tasks that constantly recur. This decentralized execution of specified tasks may be handled by individual microprocessors organized into functionally independent local subsystems. One particularly important area that must be monitored is the loading of the paths of multichannel transmission systems. Designing a local loading monitoring subsystem within the framework of an automated operating system does not present any special problems. The only obstacle is the absence of devices to monitor loading that provide a reliable assessment of the loading process and issue signals indicating its status. Theoretical and experimental research conducted on the problem has resulted in the development of a method of monitoring the paths of a multichannel transmission system that has proved to be effective under the operating conditions of an automated system. The loading monitoring algorithm developed is geared toward the organization of a continuous process and results in a monitoring cycle that is adapted to the intensity of overloading. The method developed is distinguished by the fact that the accuracy of the monitoring results is independent of the distribution function of the instantaneous values of the group signal, which makes it possible to use the method to assess different versions of the loading of paths with different numbers of channels. Using the new loading monitoring device makes it possible to implement a local subsystem to monitor the loading of transmission paths and to thus improve the operating efficiency of multichannel transmission systems. Figures 3; references 3: Russian.

Determining Structure of Millimeter Wave Range Noise-Immune Receiver for Information Transmission Systems

917G0051D Kiev MEKHANIZATSIYA I AVTOMATIZATSIYA UPRAVLENIYA: NAUCHNO-PROIZVODSTVENNYY SBORNIK in Russian No 4, Oct-Dec 90 (manuscript received 21 May 90) pp 30-33

[Article by L. G. Gassanov, corresponding member UkSSR Academy of Sciences, S. P. Glotov, N. I. Lelyukh, A. A. Lipatov, candidate of technical sciences, T. N. Narytnik, candidate of technical sciences, and V. P. Potiyenko]

UDC 621.382.658

[Abstract] As the variety and complexity of the tasks entailed in managing the economy have increased, so too has there been an increase in the requirements that have been imposed on the quality and quantity of the information sent via information transmission systems and on the quality of the transmission systems themselves.

The use of satellite communications lines operating at frequencies of about 60 GHz has proved to be especially promising. One of the main problems in creating equipment for use in transmitting information in the millimeter wavelength range is that of finding the optimal circuitry for the receiving and transmitting module. Selecting the optimal circuitry for a system's noise-immune receiver is especially important. The authors of this article use the theory of fuzzy sets as the basis for developing an algorithm to aid in selecting the optimum circuitry of receivers used in information transmission systems operating in the millimeter wavelength range. They illustrate the workings of the proposed algorithm by examining seven design versions of a noise-immune receiver for use at the millimeter wavelength range. The algorithm presented has been used by the Saturn Scientific Production Association in Kiev in developing data transmission equipment intended for use in implementing exchanges between computers in large computer centers; managing services at large airports, railway junctions, and seaports; and transmitting large volumes of information via satellite lines. Figures 1; references 3: Russian.

Software-Hardware System to Monitor and Control Backup for Network Nodes and the Stations of a Primary Network

917G0051E Kiev MEKHANIZATSIYA I AVTOMATIZATSIYA UPRAVLENIYA: NAUCHNO-PROIZVODSTVENNYY SBORNIK in Russian No 4, Oct-Dec 90 (manuscript received 15 Mar 90) pp 33-37

[Article by T. P. Bashlakova, V. G. Bondarenko, candidate of technical sciences, D. V. Volovik, N. V. Kiyanitsa, B. I. Kosyanchuk, D. F. Lipetskaya, T. V. Sborets, V. V. Tsytron, and G. P. Chernyy, candidate of technical sciences]

UDC 621.395; 621.396; 621.327

[Abstract] Using an automatic operating system for a primary network is an effective way of ensuring that the network's channels, paths, and equipment will operate with a high degree of quality and reliability. An automatic operating system is a hierarchical system. Its lowest level, i.e., its maintenance section or information and final control point, is a mass service system and is directly tied to the paths and equipment. The hardware and software automating the processes entailed in operating an information and final control point in a network node or station must therefore be rather simple, have a low power requirement, not require a great deal of metal to manufacture, and permit operation in a semiattended or even unattended mode. In view of these and other requirements, the Kiev Department of the Central Scientific Research Institute of Communications developed a system of software and hardware (called the KONTUR system) to monitor and control backup for network nodes and stations in a primary network. A pilot enterprise of the Institute began series production of the KONTUR system in 1989. This article details and diagrams the main components and workings of the system and presents the monitoring algorithm developed for use with the system. The system features a program for diagnosing the components and individual devices in the system (RAM, PROM, multiplexer, etc.) and also features a monitor-debugger. The KONTUR system has been used in a primary network to modify and improve the network's software and hardware. The system can be powered by a 24 V source and has a power requirement of 110 VA. It has been estimated that installing one KONTUR system will result in an annual savings of 4,800 rubles. Figures 3; references 3: Russian.

Automated Document Telecommunications Maintenance System

917G0051F Kiev MEKHANIZATSIYA I AVTOMATIZATSIYA UPRAVLENIYA: NAUCHNO-PROIZVODSTVENNYY SBORNIK in Russian No 4, Oct-Dec 90 (manuscript received 15 Mar 90) pp 41-42

[Article by V. N. Vrazhnov]

UDC 621.394.74

[Abstract] Along with such conventional document telecommunications services as subscriber telegraph and telegraph services open to the general public, lease telegraph channels, and low-speed data transmission, the USSR Ministry of Communications is planning to introduce a variety of new services over the next few years. These services, including teletex, fax, and videotex, will help document telecommunications enterprises increase their output and income dramatically. These new services will require a new approach to organizing document telecommunications maintenance systems based on the latest progress in electronics and computer technology. The lowest level of such automated maintenance systems consists of peripheral hardware and software installed at different sites. Such systems, including the ZOND and SKIF hardware-software systems and the Poisk [Retrieve] equipment, have already been introduced at document telecommunications enterprises. The second level of an automated maintenance system for document telecommunications services must perform a set of tasks that are more complex and hence require more powerful and faster computers. These tasks include automating operations accounting, monitoring the execution and routing of work in an enterprise's shops, creating and maintaining data bases, reception and online processing of information issued by hardware-software systems, and accumulation and statistical processing of information about the operation of equipment and communications. This level of such maintenance systems is based on IBM PC-type computers and may involve the sharing of resources by several users. The ZOND hardware-software system, which consists of an

Elektronika-60M microcomputer and an electronic unit containing a memory and interfaces and which can monitor up to eight lines, channels, etc., simultaneously, may be used at this level. The ZOND system also features two simulation modes to monitor the switching of equipment under an artificial load. Since 1989 the ZOND system has been series produced by the pilot plant Promsvyaz in Minsk. The SKIF monitoring system, which can monitor up to 4,096 station circuits simultaneously and which is also used in monitoring document telecommunications services, has been produced since 1988 by joint agreements between the Kiev Department of the Central Scientific Research Institute of Communications and various communications enterprises. Information gathered by the SKIF system may be updated every 15, 30, or 60 minutes. The system can also be used to determine loads on telecommunications system equipment over the course of days or months.

Using Section Telemechanics Equipment of the K-3600 Transmission System in an Automated Operating System

917G0051G Kiev MEKHANIZATSIYA I AVTOMATIZATSIYA UPRAVLENIYA: NAUCHNO-PROIZVODSTVENNYY SBORNIK in Russian No 4, Oct-Dec 90 (manuscript received 11 Apr 90) pp 45-46

[Article by S. B. Limonova]

UDC 621.398.9:621.395.446

[Abstract] The section telemechanics equipment of the K-3600 high-speed transmission system has great information capabilities. It does not, however, meet the requirements set for an automated operating system. When section telemechanics equipment is used in an automated operating system, the information formulated by the equipment must enter the maintenance section/information and final control point in a form that is ready for automatic reading, display, and further processing by the control computer system. Section telemechanics equipment does not afford this capability. It can, however, be made compatible with a maintenance section/information and final control point by using special interfaces to issue, process, and convert the telemechanics signals. When the volume of information issued to a maintenance section/final control point is limited, the required interfaces can be developed without great expenditures of materials or labor, and the device itself may be rather simple and inexpensive. The author of this article proposes that the required interface be implemented in the form of a standard information output device and that it be mounted in the free space in the telemechanics rack. The unit can be powered from the device used to power the section telemechanics equipment, and the information formulated may be sent to the maintenance section/final control point for display and further processes. It is further recommended that the information output device be designed to service simultaneously two section telemechanics equipment sets mounted on one telemechanics rack of the repeater station being serviced. The capabilities of the information output device/section telemechanics equipment can be further enhanced if information from the section and trunk telemechanics is used together, which will make it possible to "link" the given information to a path number. Using the proposed setup will increase the productivity of persons servicing maintenance section/information and final control points, simplify the algorithms required for transmission lines and line paths, reduce the time required to locate faults, and make systems more convenient to service.

Using Complex Signals in Information Computer Networks

917G0051H Kiev MEKHANIZATSIYA I AVTOMATIZATSIYA UPRAVLENIYA: NAUCHNO-PROIZVODSTVENNYY SBORNIK in Russian No 4, Oct-Dec 90 (manuscript received 31 Jan 90) pp 46-48

[Article by S. G. Bunin and A. M. Luchuk, doctors of technical sciences]

UDC 621.391

[Abstract] One way of developing information computer networks is to expand them by using a radio channel as a physical connection. Such radio information computer networks use both narrowband signals with a base of about 1 or complex, wideband signals with a base of $B >> 1$. The latter are used because they offer the following advantages over narrowband signals: Their frequency bands can be combined with narrowband signals to isolate the required band; several complex signals may be transmitted simultaneously in an identified band, thus simplifying the problem of multiple access to a communications channel; unsanctioned access to information in the network is made more difficult, and the fact that a network is functioning can even be hidden when signals are received with a negative signal-to-noise ratio in the communications channel; pulsed noise and noise concentrated by spectrum can be combatted effectively; distortions between characters because of multibeam wave propagation can be eliminated; and multichannel data transmission is possible. At present, most radio information computer networks use noise-like signals with sinusoidal carriers and an asynchronous address mode. Switching from an asynchronous to a synchronous address mode will reduce the transient noise in a network and will make it possible for the network to service a larger number of users. It is advisable to effect this change in networks in which packet communication occurs through a common relay (such as the Disket network). Figures 2; references 3: Russian.

Method of Calculating the Parameters of a Digital Linear Optical Path

917G0051I Kiev MEKHANIZATSIYA I AVTOMATIZATSIYA UPRAVLENIYA: NAUCHNO-PROIZVODSTVENNYY SBORNIK in Russian No 4, Oct-Dec 90 (manuscript received 15 Mar 90) pp 48-51

[Article by V. B. Katok, candidate of technical sciences, and G. P. Levchenko]

UDC 621.391.052

[Abstract] Fiber-optic transmission systems are currently the most promising information hardware systems for automated control systems. Fiber-optic systems have several advantages over systems in which metal cable is used. These include a high information capacity, low losses in the line path, and insignificant mutual effects. In most cases, information sent along communications equipment in information computer networks is sent in digital form. Because signals are distorted in a digital linear optical path, the parameters of actual digital linear optical paths must be estimated with a sufficient degree of exactitude to be able to allow for their effect on the quality of information transmission. An effective mathematical model of the linear path of actual fiber-optic transmission systems has been developed for use in studying the distortions of signals sent via digital linear optical paths. In the model, the main nodes of a digital linear optical path, i.e., the optical transmitter, fiber lightguide, and optical-band receiver, are represented in the form of sequentially connected elements whose transfer ratios are described by a series of functions. This article illustrates the use of the model developed in determining the distortions that a pulse undergoes when transmitted along a fiber-optic transmission line. The model developed has been implemented in the form of a program (written in BASIC) that can be executed on an Iskra-226 computer. The program may be used to develop an eye diagram that can in turn be used to estimate the distortions of transmitted pulses with shapes having different analytical descriptions. In other words, the proposed method can be used to investigate pulses with any physically realizable shape. The method has been used at the Zavod Arsenal Production Association in Kiev and at the Orbita Scientific Production Association in Dnepropetrovsk. Figures 1; references 6: 4 Russian, 2 Western.

Matching Demodulation Procedures and Decoding in the Digital Data Transmission Equipment of Automated Control Systems

917G0051J Kiev MEKHANIZATSIYA I AVTOMATIZATSIYA UPRAVLENIYA: NAUCHNO-PROIZVODSTVENNYY SBORNIK in Russian No 4, Oct-Dec 90 (manuscript received 27 Dec 89) pp 51-54

[Article by I. E. Onysko and B. K. Tretyakov, candidate of technical sciences]

UDC 621.391.25

[Abstract] One of the most important requirements stipulated with regard to digital data transmission equipment is that it have a specified level of noise immunity. According to standards established by the International Consultative Committee on Telegraphy and Telephony [ICCTT], the probability of distortions in the data transmission equipment used in automated control systems should be between 10^{-6} and 10^{-10}. One of the most promising ways of meeting this standard is to use noise-immune cascade coding. Binary block codes and soft decoding algorithms are used in the inner stage of such cascade codes, whereas Ride-Solomon codes and strict decoding along with error correction and deletions are used in the outer stages. Using this method results in a significant gain in noise immunity. The problem is solved in two stages: 1) matching of the demodulation and decoding procedures in the inner stage by rational selection of the number of levels of sampling the modulator's output signal and correct establishment of the quantization thresholds; and 2) matching the decoding procedures in the inner and outer stages by introducing an optimal deletion zone for the symbols of the outer code. This article illustrates the application of an algorithm for implementing this decoding procedure and describes a device for matching demodulation and decoding procedures that operates on the basis of the algorithm. Using the proposed matching device makes it possible to achieve a total noise immunity gain of 1.2 to 2.0 dB (depending on the type of code used) without expanding the frequency band of the communications channel and without greatly complicating the data transmission equipment used in the automated control system. Figures 3; references 5: 4 Russian, 1 Western.

SINTEZ-F Computer-Aided Combination Circuit Synthesis System

917G0055A Kiev UPRAVLYAYUSHCHIYE SISTEMY I MASHINY in Russian No 1, Jan 91 (manuscript received 26 Oct 89; after revision 21 Jun 90) pp 3-9

[Article by I. A. Pankratova, S. V. Bykova, L. A. Nikolayeva, and A. M. Oranov]

UDC 519.7

[Abstract] The conversion functions performed by combination circuits do not lend themselves to standardization. They require synthesis procedures that turn out to be extremely complex and laborious in most cases, hence the urgency of automating the synthesis of combination circuits. This article describes the SINTEZ-F automated system to synthesize combination circuits that was developed to meet this need. It was developed at the Siberian Physical Technical Institute of Tomsk University. In the system, the functioning of a circuit is specified by either partially or completely defined Boolean functions. In the SINTEZ-F system, circuits are synthesized by Pavlov's decomposition method in accordance with an algorithm of the AND-NOT, OR-NOT, AND-OR-NOT, and OR-AND-NOT type with different fan-ins and fan-outs. A synthesized circuit is represented either in terms of a table of connections of elements or in terms of a description in the languages SDL or SLOG. The basis of the synthesis is specified implicitly by consulting a library of reference elements. The system also includes provisions for creating or changing libraries. The SINTEZ-F system consists of about 100 program modules and has been developed in the algorithm language LYaPAS. It is designed for use on SM computers with the RAFOS or OS RV operating system or with the VAX-11 computer in the VMS operating system. For an SM computer, the load modules have a total length of about 350 Kbyte. The size of a synthesized circuit is limited only by the computer's RAM. For SM computers (which have a RAM of 56 kbytes for a program and data), it is thus possible to synthesize circuits containing up to 200 elements and implementing Boolean functions specified at 300 intervals. Tables 2; references 11: Russian.

DISASSEMBLER S/380 Retranslator for Third-Phase YeS Computers

917G0055B Kiev UPRAVLYAYUSHCHIYE SISTEMY I MASHINY in Russian No 1, Jan 91 (manuscript received 27 Mar 90) pp 20-27

[Article by A. P. Maksimenko and S. V. Nazarov]

UDC 681.3.06

[Abstract] Using disassemblers to test software results in a 5 to 35 percent reduction in the cost of discovering errors. They are also used to detect computer viruses in programs. This article describes one such disassembler, the DISASSEMBLER S/380 for third-phase YeS computers. It is designed to restore the source test of a program from a load module and is a development of the retranslator DISASSEMBLER S/370 for the Ryad-3 computer series. It is simpler to use than analogous programs and uses a smaller area of RAM (78 kbytes). Another of the advantages of the DISASSEMBLER S/380 system over its competitors is the form of its output listing, which corresponds to the listing of an assembler translator from the standpoints of external appearance and informativeness. The main advantage of the DISASSEMBLER S/380 is that it uses a two-step scheme of processing the load module. In the first step, the load module is converted to an object module; in the second step, the source text is obtained from the object module. This makes it possible to use the retranslator to restore the source text of programs of both load and object modules. The retranslator may also be used in systems that do not support the format of the load module adopted in OS 6.1 provided that the required interface module is used. The DISASSEMBLER S/380 system has been used successfully to restore fairly complex files and discover errors in the programs SMF and LSPACE. Figures 4; tables 1; references 22: 18 Russian, 4 Western.

Tabular Document Generation System

917G0055C Kiev UPRAVLYAYUSHCHIYE SISTEMY I MASHINY in Russian No 1, Jan 91 (manuscript received 20 Mar 88; after revision 23 Aug 89) pp 35-40

[Article by I. V. Parafeynikov and Yu. V. Shimbirev]

UDC 681.3.068

[Abstract] The output information of automated control and information systems is frequently in the form of tables with explanatory text. This form of data representation is commonly termed a tabular document. Compiling, formatting, and printing out such documents is generally a rather laborious process. It may be made easier by using special systems or programs to automate the functions of describing, formulating, and printing tabular documents. Most such systems do not provide an adequate level of automation, and many require that users be well versed in such programming languages as PL-1 and COBOL since many existing tabular document generators produce a document that only contains column heads and that must later have all data filled in by the user in the aforementioned languages. The proposed tabular document generation system does not have this shortcoming. It performs all of the functions entailed in describing the forms of tabular documents together with explanatory text (headings, legends, etc.), filling in the tabular data, and outputting the document to a printer, display screen, etc. The system implements both static and dynamic methods of specifying the information portion of a table. The system has been implemented on an SM computer in the OS RV operating system in Pascal. It requires about 20 kbytes. The

new system is simpler to use and more universal than its existing counterparts such as the MIRIS (MRG) data base manager and UNIBAS-M (ARW). In some respects, the new system even surpasses its counterparts (for example, with respect to using a minimal amount of memory and compiling complex tabular structures). Figures 2; references 10: 9 Russian, 1 Western.

Estimating a Central Processor's Operating Parameters at the State Level

917G0055D Kiev UPRAVLYAYUSHCHIYE SISTEMY I MASHINY in Russian No 1, Jan 91 (manuscript received 13 Mar 89) pp 40-45

[Article by V. V. Grek, K. A. Kirin, A. A. Suvorov, and G. I. Tochitskaya]

UDC 681.326

[Abstract] One of the recent main directions in improving computer architecture has been that of switching from executing algorithms at the software level to executing them at the hardware or firmware level. This switch makes it possible to raise a computer's productivity in relation to its cost and reduce operating system overhead resulting from time expended to control multiprogramming, resource sharing, and processing of interrupts. The initial stage of executing operating system algorithms at the hardware or firmware level consists of estimating the level of the operating system overhead. This article describes a method of conducting a one-factor experiment to gather statistical data about the overhead costs of the YeS operating system at the level of the central processor's states. The following central processor states are considered: the supervisor state, the wait state, the task with a zero protection key state, and the task with a nonzero protection key state. The methodology of the experiment and the resultant data are discussed in detail. The measurement method examined may be used in formulating measurement experiments on YeS computer systems, and the resultant statistical data in the form of mean and standard deviations of random variables may be used as input data for forecasting models (analytic and simulation) of the quality indicators of various computer systems. Figures 2; tables 1; references 3: Russian.

Distributing Priorities Between the Components of a Real-Time Process

917G0055E Kiev UPRAVLYAYUSHCHIYE SISTEMY I MASHINY in Russian No 1, Jan 91 (manuscript received 28 Nov 88) pp 45-51

[Article by V. V. Kaysin]

UDC 681.3.06

[Abstract] Developing manufacturing for a real-time system requires solving the problem of maintaining a priority discipline. For servicing requests (interrupts) from information sources with different priorities, this problem is solved at the hardware level, i.e., by using a vector interrupt mechanism in the computer. In a number of cases, however, it is necessary to distribute priorities within the framework of one process (servicing one source) among its components. The author of this article proposes a rather simple (from a software design and maintenance standpoint) and efficient (from the standpoint of required software and hardware) solution to this problem. The method is explained by way of the example of its use with a recognition system that must perform the functions of data input (digitization), signal detection, recognition, and processing of the recognized signal based on the respective algorithm. In essence, the method calls for designing the system algorithm in terms of an "interruptable" interrupt-processing program. The proposed solution was used in developing a real-time software system for SM-4 computers. It proved to be convenient for use in designing and modifying software and resulted in software with high performance characteristics. References 3: Russian.

Limiting Access to Information in the YeS Computer Operating System

917G0055F Kiev UPRAVLYAYUSHCHIYE SISTEMY I MASHINY in Russian No 1, Jan 91 (manuscript received 20 Apr 90; after revision 23 Aug 90) pp 61-70

[Article by S. G. Kalinin]

UDC 681.3

[Abstract] The standard means of limiting access in operating systems 6.1 through 7.2 for YeS computers gives users the capability of organizing password protection of data sets located in volumes of magnetic tape with standard labels and volumes of magnetic disks. Only individuals with the correct password can work with a data set. The PASSWORD data set has been created to set up protection in the resident volume of the operating system. Stored in it are the names of all protected data sets and the passwords for access to them. To protect against unauthorized access, a user may use either password protection or the PASSWORD set itself. This article examines the main principles of limiting access to information in the aforementioned YeS computer operating systems. Particular attention is paid to the factors preventing application of the principle of limitation to multitask computing processes. Also examined in detail are the main concepts underlying the SAZ/P1.1 program package, which enhances the standard capabilities of the aforementioned operating systems in the area of password protection during parallel processing of protected and unprotected data. Figures 2.

A Local Area Network With Diverse Operating Systems (Concise Report)

917G0055G Kiev UPRAVLYAYUSHCHIYE SISTEMY I MASHINY in Russian No 1, Jan 91 (manuscript received 1 Mar 89) pp 70-72

[Article by Ye. V. Basenko and A. V. Letov]

UDC 681.3.06

[Abstract] One way of increasing the productivity and efficiency of using computer technology is to create distributed data processing systems based on multicomputer systems with a network architecture. Particularly feasible are local area networks in which computer systems with a simple architecture (for example, the Elektronika-60 or DVK) have access (via the respective hardware or software) to peripherals and tasks of a more powerful computer system. This concise report describes the KORSAR [combined radial network architecture) network software system. It is intended to link computer systems functioning under the control of diverse operating systems into a local area network with a radial structure. The KORSAR software enables computers of the Elektronika-60 or DVK types that are controlled by the RT-11 operating system (version 0.5.04) to function in a network with an SM-4 or SM-1420 computer by using the OS RV operating system (version 3.0). The KORSAR system may be divided into two parts: software for the central computer and software for the peripheral computers. The KORSAR system performs the following functions: loads the RT-11 operating system along communications lines from the disk device of the central system to the peripheral systems, emulates the central system's disk devices in the peripheral systems, accesses the programs of the peripheral system to the sequential-access call devices of the central system, synchronizes and exchanges messages between the different systems to coordinate their operation, and triggers tasks in the central system upon receipt of a request from a peripheral system. The technical characteristics of the KORSAR network software system are as follows: size of the UU driver, 13 blocks; area of memory occupied by the driver, 858 words; size of the DEP program, 40 blocks; area of RAM occupied by the DEP program, 9,632 words; size of the KR driver, 6 blocks (XRDR.TSK) or 1 block (XRDR1.STB); area of RAM occupied by the XR driver, 576 words; and speed at which information is read from an SM-5400 disk (assuming only one active peripheral computer), 3.5 to 4 kbyte/s. References 6: Russian.

Implementing the Linguistic Processor of an Expert System Based on Relational Models

917G0055H Kiev UPRAVLYAYUSHCHIYE SISTEMY I MASHINY in Russian No 1, Jan 91 (manuscript received 27 Apr 89; after revision 14 Mar 90) pp 73-79

[Article by N. G. Likhogrud and M. F. Korshenko]

UDC 68.3:624.01

[Abstract] A linguistic processor is one of the components of an expert system. It is intended to convert an instruction made by a user in natural language into an internal representation that is relevant to the meaning of the source instruction. In some cases, a linguistic processor also formulates a response to the user in terms of natural language. This article examines the distinctive features of implementing the linguistic processor of an expert system based on the formalism of the calculus of predicates and relational algebra. According to this formalism, sets of the predicates' truth values are interpreted as relationships involving linguistic objects. The process of implementing such a linguistic processor is examined by way of the example of an expert system for the computer-aided design of reinforced concrete structures. The proposed approach has been used with a YeS1061 computer in the DEMOS operating system in the programming language C with the INGRES relational-type data base manager. The data base relationships correspond to sets of truth values of the predicates f1-f17. The linguistic processor developed requires no more than two to three minutes to analyze a natural language instruction consisting of 100-120 predicates. The linguistic processor proved to be effective when used in the CAD for reinforced concrete structures that is examined herein and may be used with other CAD systems as well. Figures 1; references 7: Russian.

Hybrid Expert System for Designing the Technical Base of the Ekspert-Set [Expert-Net] Distributed Data Processing System

917G0055I Kiev UPRAVLYAYUSHCHIYE SISTEMY I MASHINY in Russian No 1, Jan 91 (manuscript received 4 Jun 90) pp 79-84

[Article by R. A. Aliyev, T. S. Abdullayev, and R. B. Alekperov]

UDC 681.324

[Abstract] Creating integrated automated management systems for enterprises with a continuous manufacturing cycle requires the development of a distributed data processing system based on a local area network. Local area networks exist in a variety of different types and configurations. This complicates the process of designing and selecting a local area network to accomplish the tasks required of a specific distributed data processing system. It should be noted that the process of designing a network will be affected by a series of factors, including the low reliability of the source data, the fuzziness of the quantitative and qualitative values of selected technical characteristics of existing local area networks and their components, the incompleteness of information regarding the volume and traffic of information streams in the event of changes in the production structure of the facility being managed, etc. Existing systems for designing networks based on the use of optimization methods and heuristic procedures or on a combination of them do not permit designers to give adequate consideration to the effect that the aforementioned factors have on the process of designing a local area network. In an effort to help automate the process of designing a local area network under conditions of incomplete information, the authors of the present article have developed the Ekspert Set [expert net] system. Ekspert Set is a hybrid expert system for designing the technical base of

a distributed data processing system. The new system is based on artificial intelligence methods. The system includes an expert subsystem and a subsystem for computing a local area network's characteristics. The expert subsystem includes the standard units of expert systems and is intended for use in accomplishing the following tasks: designing the technical base for each user node of the local area network, designing the network topology, developing a method of access to the transmitting environment, determining the speed of data transmission, developing the technical base of the local area network's stations, and developing network software. The computation subsystem is intended for use in computing the following characteristics: intensity of the stream of packets in the local area network, average packet delay time, reliability, and adjusted costs of the local area network. Data and knowledge bases have also been created for the Ekspert Set system. The contents of the knowledge base has been organized and represented in the form of production rules. The Ekspert Set system has been implemented in Turbo-Pascal on an IBM PC/XT with 640 kbytes of memory. The system has been used successfully to design the technical base of the distributed data processing system of the integrated automated management system of the Novo-Bakinskiy Oil Refinery. The network in question is designed to service 20 users. In the new network, 60 files are used to perform 45 functional and service tasks entailed in managing nine facilities. Figures 1; references 9: Russian.

Investigating the Effect of Digital Coding Parameters on Errors in Estimating the Probability Characteristics of a Radar Echo Signal

917G0055J Kiev UPRAVLYAYUSHCHIYE SISTEMY I MASHINY in Russian No 1, Jan 91 (manuscript received 28 Sep 89; after revision 16 Jan 90) pp 85-92

[Article by R. N. Kvetnyy, A. A. Ursatyev, and G. Ya. Chumakov]

UDC 631.397.96:631.6

[Abstract] The validity of the results of full-scale studies of radar reflections to determine their statistical characteristics (such studies are conducted when developing optimal algorithms for detecting different types of objects against a background of noise reflections) depends on accurate knowledge of the effect of errors in estimating the signals' parameters. Most such errors result from the measuring path of the scientific research automation system, i.e., the unit responsible for digital conversion of the radar signal, which is in turn based on a high-speed analog-to-digital converter. The task of selecting optimal parameters for a coder's analog-to-digital converter and then investigating their effect on errors in estimating the probability characteristics of signals may be solved by plotting and analyzing probability models of the analog-to-digital converter. It is critical that the effect of the operations of digitization and quantization on the probability characteristics be estimated when modeling analog-to-digital conversion in the simplest case. This is because the operation of quantization changes the distribution law and affects the correlation function because of its nonlinearity, with the degree of this effect depending on the form of the distribution law. Existing methods for the probability modeling of analog-to-digital converters are based on estimates of the mathematical expectation and variance of the random sampling error, which is clearly inadequate when modeling the conversion that takes place in an analog-to-digital converter of stochastic processes (because the distribution law governing such processes is not normal). In their approach to constructing probability models of analog-to-digital converters, the authors of the present article use a methodology of analytic probability modeling. According to this approach, the model is constructed in the form of two interconnected models of the transformation of the distribution laws governing the probabilities of random signals and correlation functions. Rather than using the functional transformation of signals in accordance with the designation of the elements of the system under consideration, this approach involves modeling the transformation of signals' probability characteristics. The probability characteristics are presented in explicit form. When the approach is implemented on a computer, the probability characteristics are represented in the form of two-dimensional arrays of discrete values of the probability density and correlation function of a random signal. The proposed method of probability modeling of the analog-to-digital conversion of signals may be used in information computer systems to forecast metrologic characteristics and as a means of making more intelligent measurements. Figures 5; tables 4; references 11: Russian.

An Applications Package for Analyzing the Reliability and Survivability of Structurally Complex Circuits

917G0055K Kiev UPRAVLYAYUSHCHIYE SISTEMY I MASHINY in Russian No 1, Jan 91 (manuscript received 24 May 89) pp 93-103

[Article by A. A. Gagin and O. V. Klimovskiy]

UDC 621.395.2.019.3

[Abstract] Guaranteeing required reliability and survivability levels is one of the main problems in designing and operating complex technical systems. The ANONS applications package has been developed to assist designers in analyzing reliability and survivability when developing structurally complex circuits. The ANONS package makes use of existing and newly developed (by the authors of the present article) mathematical models and methods for analyzing reliability and survivability. In developing the ANONS applications package, the

authors used a two-level model as the basis for developing software to compute the exact values and double-ended estimates of the reliability of reparable structurally complex systems that may contain up to hundreds of elements. To analyze the survivability of structurally complex circuits, the authors have developed an analysis method for two rather general models of unfavorable effects, a model of a passive strategy and a model of an active strategy. The applications package has been designed for use with computers in the YeS series, beginning with the YeS1022, or with IBM PC compatibles in the OS Yes (version 4.0 or higher) or MS DOS operating systems. The applications package is written in Fortran-IV and requires 150 to 320 kbytes of RAM and 2 Mbytes of disk memory. The ANONS applications package has been tested on a YeS1033M and an IBM PC. Figures 3; tables 1; references 13: 11 Russian, 2 Western.

An Applications Package for Reducing the Dimensionality of a Description Space (Concise Report)

917G0055L Kiev UPRAVLYAYUSHCHIYE SISTEMY I MASHINY in Russian No 1, Jan 91 (manuscript received 13 Jul 89; after revision 20 Nov 89) pp 103-106

[Article by A. N. Chetyrbotskiy]

UDC 519.92

[Abstract] The problem of reducing the dimensionality of a description space arises when it is necessary to reduce the initial set of attributes of multidimensional observations to a much smaller set of adequate aggregate indicators. Such reduction is necessary, for example, when the large initial dimensionality of a set makes it impossible to solve the problems at hand in an acceptable amount of time or when a detailed description of multidimensional observations is unnecessary. A solution to the specified problem exists if the sample of points of some multidimensional space (of observations, objects, or specimens) belongs to a topological space with a much smaller dimensionality. This brief report describes an applications package that has been developed especially to perform such reductions. The applications package can be used to process a sample consisting of up to 150 objects. The applications package executes the following computer algorithms: the method of main components, fast nonlinear mapping, a recursive method of mapping the points of a multidimensional space onto a numerical axis, and multidimensional and functional scaling in the presence of specified classes of objects. The package makes use of four methods of constructing criteria to assess the quality of the mapping of objects. The following processing algorithms are executed during the course of the multidimensional scaling procedure implemented by the applications package: estimation of the parameters of the models of a canonical correlation analysis, estimation of the parameters of the regression models, restoration of the histogram of the density distribution of the individual attributes based on minimizing the mean risk, construction of contingency tables, and plotting of graphs and tables on an alphanumeric printer. The applications package described is designed for use on YeS computers (model YeS1035 or higher) with at least 512K memory. The package has been used at the Far Eastern Geologic Institute of the Far Eastern Department of the USSR Academy of Sciences in constructing aggregate indicators of the accumulation of precipitation in the continent-ocean transition zone and at the Far Eastern Naval Scientific Research Institute and Far Eastern Polytechnic Institute imeni V. V. Kuybyshev to perform various tasks related to the classification of multidimensional observations. References 16: Russian.

An Authoring System for Designing Computer-Assisted Instructional Courses for an AOS-VUZ System

917G0055M Kiev UPRAVLYAYUSHCHIYE SISTEMY I MASHINY in Russian No 1, Jan 91 (manuscript received 21 December 88; after revision 11 May 89) pp 107-114

[Article by V. N. Komlichenko and S. V. Novikov]

UDC 681.3

[Abstract] From the standpoint of expressive capabilities, the most popular computer-assisted instructional systems such as AOS-VUZ [computer-assisted instructional system for higher educational institutions] and others that use the authoring language YaOK are in no way inferior to algorithmic programming languages. The language YaOK is, however, difficult to master for individuals who are not professional programmers. This fact is especially important in view of the fact that most of those responsible for developing computer-assisted instructional [CAI] materials are educators and psychologists rather than programmers. As a result, there is a need to develop tools that would free authors of CAI materials from programming scenarios in algorithmic language and that would store the experience of previous developments of CAI materials in different disciplines along with the results of didactic theories and educational psychology in the area of computer-assisted instruction. This article describes one such automated system for designing CAI course materials, i.e., the AS PAUK. An individual using the AS PAUK system for creating CAI course materials needs only (1) knowledge in the subject area being automated and (2) a basic understanding of the techniques of developing a "preliminary" scenario of the CAI course materials being designed. Then, in an interactive process based on a menu format, the teacher-author is provided with the information needed to formulate and fine-tune an instructional module. The course materials are designed in a language of structured diagrams and are converted by the AS PAUK system to the language YaOK. This article details the components, capabilities, and experience that has been accrued in using the AS PAUK

system. The first version of the AS PAUK authoring system has been fully debugged and may be installed for immediate use. Other related software systems that were developed during the process of creating the AS PAUK system are also described. One of these software products is the YaOK87 program, which allows users to master the basics of programming in YaOK in only 12 hours of contact time. Figures 1; tables 1; references 6: Russian.

Local Network of Enterprise Automated Workstations (Concise Report)

917G0055N Kiev UPRAVLYAYUSHCHIYE SISTEMY I MASHINY in Russian No 1, Jan 91 (manuscript received 8 Dec 88; after revision 11 Apr 89) pp 114-118

[Article by V. N. Antonov]

UDC 658.015.12.011.56:681.322.181.4

[Abstract] This concise report describes the development of a local area network consisting of automated workstations for enterprises involved in shipping products as a part of a republic's central material and technical supply network. The network is based on the following concepts: 1) creation of a rather universal network linking automated workstations in the form of a data transmission network; 2) use of a standardized method of connecting automated workstations to the data transmission system; and 3) use of a flexible, steplike organization of the network's distributed operating system so as to permit effective interactions of remote processes and to permit quick changes in the configuration of the automated workstations created and to be able to expand and modify the network by connecting virtually all types of modern computers and automated workstations to it. The automated workstations in question are unique in that they may be considered intelligent automated workstations. In other words, they represent an organizational-technological and software-hardware system intended primarily to permit a professional worker who is not a professional programmer to achieve real-time "flexible" automation based on a "friendly" personal computer. The key element in an intelligent automated workstation is an efficiently organized data bank consisting of data, knowledge, and objective bases controlled by a centralized data base manager. This article details the underlying principles, functions, and components of the intelligent automated workstations designed to be part of the network of enterprise automated workstations described. The intelligent workstations may be used to organize various local and global networks featuring high productivity, improved readiness and reaction time, adaptability and the capability of dynamic reconfiguration, improved reliability and survivability, and relatively low cost. The drawbacks of the proposed intelligent workstations include the increased complexity and cost of the system and applications software required and the need for complex and expensive diagnostic equipment to locate hardware and software errors. Figures 2; references 14: Russian.

Structural and Functional Analysis of Information Service Systems for Administrative Workers Using Personal Computers

917G0054A Kiev MEKHANIZATSIYA I AVTOMATIZATSIYA UPRAVLENIYA: NAUCHNO-PROIZVODSTVENNYY SBORNIK in Russian No 1, Jan 91 (manuscript received 15 Sep 89) pp 8-12

[Article by G. B. Melentyev]

UDC 658.012.011.56:681.31-181.4:65.011.54/56

[Abstract] The current stage in the development of automation of organizational management at enterprises, organizations, and institutions is characterized by the increasingly wider-scale use of personal computer-based information systems. Such systems are mainly used to automate collective administrative work in the enterprise management apparatus and are created by the end users themselves. These systems are very different from conventional automated management systems, which are generally classified under the heading of office automation. The Gorsistemotekhnika Scientific Production Association in Kiev has investigated one such type of system that has been termed an information service system for administrative workers. This article details the system for classifying information service systems that was developed during that investigation. According to the classification system, information service systems may be classified by type (i.e., hierarchical, star, network, ring, bus, and mixed) and number of levels. They may also be classified in terms of the extent of their connection with other systems (i.e., by whether they are local, interfaced, weakly connected, strongly connected, or completely connected systems). They are further classified with respect to their echelonization (degree of branching) and by the extent of the monopoly (exclusivity), subordination, and transitivity in their structural organization. A functional classification is also proposed to supplement the structural classification of information service systems. Specifically, an information service system may be classified as a functional module (an individual subsystem that performs a separate function or set of administrative tasks in the system), a technological module (responsible for servicing manager-user's information requests on the basis of queries or algorithms), a control module (for changing the procedures according to which the system functions at the manager-user's discretion), and an organizational module (the presence of which predetermines the possibility of the system's development). Information service systems can be further classified as workstation, subdivision, and enterprise information service systems. They may also be classified as being function-, problem-, technologically-, methodologically-, information-, organization-, and object-oriented systems. This proposed functional classification has been used by the Gorsistemotekhnika Scientific Production Association in developing a set of methodological materials on creating personal computer-based information service systems for administrative workers. A software package to analyze and model information service system structures (the SIAM-2) has also been developed. It will permit end users to automate the processes entailed in personal and collective administrative work based on 16-bit personal computers. References 3: Russian.

Software for Functionally Specialized Automated Workstations in an Integrated Automated Management System for an Economic Facility

917G0054B Kiev MEKHANIZATSIYA I AVTOMATIZATSIYA UPRAVLENIYA: NAUCHNO-PROIZVODSTVENNYY SBORNIK in Russian No 1, Jan 91 (manuscript received 26 Dec 89) pp 16-18

[Article by V. N. Antonov, candidate of technical sciences, and A. G. Postevoy, candidate of economic sciences]

UDC 658.8.07.015.12.011.56.005:681.3.06

[Abstract] One characteristic feature of modern integrated automated management systems is that they include the prerequisites for designing expert systems and creating systems to support administrative and planning decision-making. Automated workstations represent one of the main ways in which such systems can be interactively created in an integrated automated management system. This article proposes a classification of software for use with automated workstations of this type. The software developed for use with integrated automated management systems consists of system software, applications software, and instructional materials on its use. The system software consists of the operating systems of the inhomogeneous multicomputer system that constitutes an integrated automated management system for an economic facility. The applications software includes sets of programs to input, check, and correct source data; process data in accordance with the integrated automated management system's algorithms; and formulate and output information from the system. An enterprise integrated automated management system consists of a set of subsystems, each requiring its own specialized software. These subsystems include administrative activity, organizational management, accounting, process control, preparation and processing of primary data, processing of statistical data, and processing of data regarding the system's operation. A portion of the applications software is software for functionally specialized automated workstations. Such software is generally written in BASIC for use on desktop computers. Some of it is developed for preparatory and processing workstations, and some is developed for collectively functioning or group workstations. The latter is intended for use by specialists who perform functionally similar tasks but who may perform them at different times. Another subtype of this software is intended for use in real-time

decision-making by different specialists under specific conditions. Yet another type of software for use in integrated automated management systems at economic facilities is software designed to collect daily operating, retrospective, and forecasting information in the form of regulated statements. This proposed classification method has been used in developing a system of integrated automated workstations for the Krolevets Mechanical Repair Plant in the UkSSR. Figures 3; references 3: Russian.

Estimating the Reliability of an Automated Process Control System's Hardware System by the Method of Confidence Limits Without Preplanning

917G0054C Kiev MEKHANIZATSIYA I AVTOMATIZATSIYA UPRAVLENIYA: NAUCHNO-PROIZVODSTVENNYY SBORNIK in Russian No 1, Jan 91 (manuscript received 20 Sep 89) pp 19-22

[Article by A. A. Bychkov and N. A. Shishonok, candidates of technical sciences]

UDC 658.012.011.56-192

[Abstract] Experimental estimation of the reliability of the hardware system of an automated process control system is generally a part of the process of verifying that the system conforms to the requirements specified in its design proposal. Because the time required to make such an estimate is not known in advance, it has been necessary to switch to an estimation procedure using confidence limits without preplanning. The essence of this procedure is as follows: During the mathematical processing of the data, the lower bound of the confidence interval is combined with the standard value of the reliability index, and the upper bound is compared with its acceptance level. If the acceptance level is surpassed or at least met, it is assumed that the object being inspected conforms to the reliability requirements stipulated in its specifications. Otherwise, measures must be taken to make the product conform to its specifications. Mathematical processing of the data is performed only when it guarantees the required reliability of the conclusion, i.e., an acceptable (sufficiently low) probability of error. Of course, the accuracy of any reliability estimate depends on the correctness of the product reliability standards developed for the automated process control system hardware systems, and efforts must be made to ensure that such standards are accurate and reliable and reflect a sufficiently long observation of the given object undergoing evaluation. Reliability estimates made by using this procedure may be based on one of two quantities: the mean time between failures and the system's availability. This article includes calculations illustrating the experimental verification of reliability indicators based on each of these two quantities. These calculations are based on assumptions and constraints that have been adopted in existing technical standards and methodological documents and confirmed in actual practice. The recommendations included in the article have been used in developing a program and method for determining the performance reliability indicators of a specific control system and may be used by developers and customers alike when evaluating analogous systems. Figures 2; tables 1; references 3: Russian.

System for Operations Planning and Control of Engineering and Manufacturing Systems

917G0054D Kiev MEKHANIZATSIYA I AVTOMATIZATSIYA UPRAVLENIYA: NAUCHNO-PROIZVODSTVENNYY SBORNIK in Russian No 1, Jan 91 (manuscript received 2 Jan 90) pp 22-26

[Article by S. A. Khmelnitskiy, L. S. Yampolskiy, candidate of technical sciences, and A. V. Bogdanov]

UDC 658.512.2

[Abstract] Various objective factors have necessitated the development and introduction of automated control systems for engineering and manufacturing systems with a closed-loop manufacturing cycle. Introducing such systems will help increase labor productivity, reduce the duration of the manufacturing cycle, and improve product quality. Such systems require that an integrated approach be taken to planning and controlling the process of developing and producing a product from the design documentation development stage to the point when the finished product is produced. In an effort to accomplish this, the Elektronmash Production Association in Kiev developed an automated control system for an engineering and manufacturing system to produce special manufacturing equipment. The automated control system developed includes three large subdivisions: a design office to design the equipment, a group to handle the technological preparation of production, and a shop to produce the equipment. This article details the workings of each of the subdivisions and the measures that have been taken to unify them into an integrated system. The system's operation is modeled in terms of a Petri net, which makes it possible to formulate all of the control processes at each level based on unified mathematical and methodological approaches. The system also features information retrieval, design documentation storage, technological preparation of production, and operations planning subsystems. The automated control system described is based on an SM 1420.03 minicomputer using the OS RV 3.1 operating system with a KARS data base manager. The savings resulting from introducing the new system have been estimated at 140,000 rubles. Figures 2; references 2: Russian.

The Stages in and Dynamics of the Development of a System for Automated Structural and Technological Design of Special Machine Tools and Automated Lines

917G0054E Kiev MEKHANIZATSIYA I AVTOMATIZATSIYA UPRAVLENIYA: NAUCHNO-PROIZVODSTVENNYY SBORNIK in Russian No 1, Jan 91 (manuscript received 30 Aug 89) pp 26-29

[Article by G. M. Kleshchev]

UDC 658.512.011.56.001.7

[Abstract] The Odessa Special Machine Tools Special Design Office has developed the subsystems and first phase of an automated design system for use in the structural and technological design of special machine tools. The system consists of the following five subsystems: engineering calculations, electrical equipment, text documents, automated lines, and components and subassemblies. The goal of this project was to restructure the methods and techniques of the existing design process, make it shorter and less laborious, increase the productivity of designers using the system, reduce the associated production costs, make the subsystems more flexible, and simultaneously improve the quality of the technical documentation generated during the design process. The developers at the Design Office in Odessa set out to create a system with artificial intelligence, i.e., a logically thinking robot. The adaptive automated design system they developed turned out to be an integrated system featuring the following units: a program perceptual field unit; a comparison, recognition, and estimation unit; a reference standards information unit; and a unit to allow for manufacturing conditions. The system features logical diagrams and models in the form of reference standards and knowledge banks that were accumulated over the course of many years. Introducing the integrated system developed made it possible to reduce significantly the cost of designs and the time required to develop them while simultaneously improving their quality, increase the percentage of standard subassemblies and components suitable for use, reduce the amounts of metal required to manufacture the machine tools designed with the system, and free highly qualified specialists to do more creative work. It is anticipated that introducing the integrated system will result in an annual savings of about 120,000 rubles. Figures 3; references 4: Russian.

Effective Use of Debugging in the Series Production of Microprocessor Systems

917G0054F Kiev MEKHANIZATSIYA I AVTOMATIZATSIYA UPRAVLENIYA: NAUCHNO-PROIZVODSTVENNYY SBORNIK in Russian No 1, Jan 91 (manuscript received 1 Nov 89) pp 31-34

[Article by A. A. Dashkovskiy, Yu. I. Melnik, T. G. Sapsay, Ye. M. Shvets, candidate of techical sciences]

UDC 681.3

[Abstract] Various debugging methods are used in manufacturing microprocessor systems. These include hardware-software debugging systems with different levels of complexity, assessment modules, logic analyzers, work generators, debugging stands, etc. The selection of the debugging method to be used depends on the accessibility of the different methods, the complexity of the system being designed, the developer's experience, and the batch size in which the microprocessor system in question will be manufactured. Hardware-software debugging systems are highly productive and enable developers to design microprocessor systems based on different microprocessor equipment. Such debugging systems are expensive, however, and they are still not being produced domestically in quantities sufficient to meet demand. Furthermore, the high cost of universal debugging systems precludes their use when manufacturing microprocessor systems in small batches because the costs of the debugging system cannot be fully recouped. The Analitpribor Scientific Production Association in Kiev has developed a new debugging system that is feasible to use. The new hardware-software debugging system, programmer stand, and debugging stand are all based on series-produced microcomputers and functional modules in the Elektronika S5 family. The new debugging tools permit parallel development and debugging of hardware and target programs. The programmer stand and debugging stand provide an optimal level of automation and parallelism of the operations entailed in manufacturing microprocessor systems and increase the efficiency of using and servicing the debugging tools during the manufacturing process. The debugging system is intended for use in debugging microprocessor systems developed on the basis of microcomputers or single-chip microcomputers in the Elektronika S5 family. All functional modules in the system feature electrical, program, and design compatibility. The programmer stand is intended for use in programming memory microcircuits during their series production. The programmer features intake inspection and electrical writing of information into memory circuits with ultraviolet erasure, checking of the information written, diagnosis in the event that it is entered incorrectly, and checking of the memory module after the programmed microcircuits have been installed. The debugging stand operates on the basis of an effective and economic method of testing by static signals. This makes it possible to debug hardware during both the development and manufacturing processes. Calculations demonstrated that using the debugging stand and programmer stand to debug one microprocessor system costs 2,355.4 rubles, whereas using the hardware-software debugging system to debug the same microprocessor system cost 4,850.85 rubles. Further calculations revealed that the hardware-software debugging system is economically feasible to use when producing a microprocessor system in a batch size of at least 420 units; in smaller batches it is advisable to use a set of simpler and less expensive debugging tools. The debugging stand and programmer stand described are being used at the Analitpribor in manufacturing microprocessor systems. Figures 3; references 2: Russian.

Standardizing Interfaces in Data Transmission Computer Networks

917G0054G Kiev MEKHANIZATSIYA I AVTOMATIZATSIYA UPRAVLENIYA: NAUCHNO-PROIZVODSTVENNYY SBORNIK in Russian No 1, Jan 91 (manuscript received 27 Jan 89) pp 39-42

[Article by V. P. Kovtun, candidate of technical sciences, and G. A. Panteleyenko]

UDC 681.327.8

[Abstract] Wide-scale development and introduction of information control computer networks is being held up for a number of reasons. One such reason is the absence of series-produced standardized interfaces. Remedying this situation would reduce the capital investments and labor input required to develop information control computer networks. The task of creating one standard interface for all types of interaction protocols is very different owing to the presence of a large number of standards for different information control computer networks and a lack of unified requirements for such systems. Consequently, standard interfaces can be developed, but only within the framework of a single All-Union State Standard [GOST], single Branch Standard [OST], or single information control computer network. The problem is further complicated by the fact that in the USSR, both existing and planned information control computer networks are based on models with different numbers of levels of interaction. The authors of this article propose that the USSR take steps to develop a standard interface. They further recommend that this standard interface be developed with an eye toward eventually conforming to the seven-level model of organizing applications processes in information control computer networks that is currently recommended by both the International Consultative Committee on Telegraphy and Telephony [ICCTT] and the International Organization for Standardization [ISO]. The authors proceed to offer specific suggestions regarding measures to achieve the following specific steps in the process of developing a standard interface: standardize the connections of the physical line (depending on the distance and parameters of the signals being sent), standardize requirements related to the connection within equipment, develop or select a microcontroller, and standardize the secondary electric power sources. Figures 1; references 3: Russian.

Diagnosing Objects on the Basis of Their Inspection Status

917G0054H Kiev MEKHANIZATSIYA I AVTOMATIZATSIYA UPRAVLENIYA: NAUCHNO-PROIZVODSTVENNYY SBORNIK in Russian No 1, Jan 91 (manuscript received 15 Mar 90) pp 42-44

[Article by A. V. Dikarev, candidate of technical sciences]

UDC 621.391

[Abstract] The task of conducting a real-time running check on a large number of objects with multiple parameters is critical in view of the wide-scale introduction of microprocessors and control computer systems. The task is easily performed by conventional methods in the case of objects subjected to disturbances having a constant distribution, i.e., when only the parameters of the distribution change over time. When the disturbances are nonstationary and when they are coupled with random errors in the object being inspected, however, the task of diagnosis becomes much more complicated. This article describes an approach to diagnosing such objects on the basis of their inspection status. The procedure is based on checking the status of n parameters of the object undergoing inspection in some time interval N. N is assumed to be the number of status checks of the j-th parameter of the inspected object during the course of the time interval N (i.e., the time required to initially inspect each of the n parameters). It is further assumed that P(M, N) represents the probability of the appearance of M errors in block N. The following diagnostic algorithm is then implemented: 1) determine and select normal and critical inspection states (critical states being those in which a failure or accident occurs) for all of the parameters of the object undergoing inspection; 2) specify one or more types of links for blocks of parameters with the initial length N for the inspection status; 3) find two limiting distributions or one average distribution of P(m, n) characteristic with respect to the component block n for all inspection states; and 4) compare the running and limiting or average distributions of P(m, n) characteristics for all inspection status during the process of diagnosing the inspected object and determine the moment when the object being inspected enters a new state. The method of diagnosing discrete objects on the basis of their inspection status that has been described herein has been implemented in software for automated operations maintenance of the country's primary trunk line communications network. References 3: Russian.

An Operator's Link Concentrator in the Automated Operating System of a Primary Communications Network

917G0054I Kiev MEKHANIZATSIYA I AVTOMATIZATSIYA UPRAVLENIYA: NAUCHNO-PROIZVODSTVENNYY SBORNIK in Russian No 1, Jan 91 (manuscript received 15 Mar 90) pp 44-45

[Article by V. A. Bovtruk, B. I. Vitenko, A. L. Sharyy, and A. B. Chumak]

UDC 621.296; 621.396

[Abstract] The efficiency of introducing an automated operating system in a primary communications network depends largely on the organization of the local subsystem of operator's links in the network centers and exchanges. An operator's link concentrator like the one used to create a local operator's subsystem in the line equipment shops of the network centers and stations of the primary network of the

Unified Automated System of Communications for the USSR may be used to establish a local subsystem of operator's links to serve as part of the information network of an automated operating system at network centers and exchanges. Combining a local subsystem of operator's links with an operator's link concentrator panel and the control computer system of a maintenance section/information and final control point makes it possible to set up telephone communications using the channels and lines of the operator's link of an operator's workstation in the maintenance section/information and final control point. An operator's link concentrator may be used for the following purposes: concentrate operator's links at an operator's workstation by remote connection of the operator's link concentrator to the channels of analog and digital operator's link equipment that already exists or that is being developed; conduct conversations by using either a telephone handset of a operator's link concentrator panel or a separate telephone set via operator's channels or lines; send and receive calls by using the respective control and display devices of the operator's link concentrator and control computer system; and disconnect (block) acoustic or optical signaling regarding the receipt of a call along the operator's lines when they are connected to the operator's telephone set without stopping calls along the remaining operator's channels. The operator's link concentrator consists of a tabletop-type panel and switching and control equipment rack. Up to 24 operator's channels and lines can be connected to it. Series production of the operator's link concentrator is planned to begin in 1992 at the Kiev Department of the Central Scientific Research Institute of Communications. It is anticipated that installing 100 operator's link concentrators will result in a savings of 150,000 rubles. References 1: Russian.

Optimizing the Time Required to Deliver Messages From Several Sources to an Automated Control System Center

917G0054J Kiev MEKHANIZATSIYA I AVTOMATIZATSIYA UPRAVLENIYA: NAUCHNO-PROIZVODSTVENNYY SBORNIK in Russian No 1, Jan 91 (manuscript received 27 Dec 89) pp 45-48

[Article by S. G. Aleksandrov, N. A. Mitrakhov, and N. F. Radishevskiy, candidate of technical sciences]

UDC 681.324

[Abstract] One of the main ways of ensuring the survivability of a regional automated control system when one of its centers fails is to use a mechanism guaranteeing the delivery of information to users. Messages not delivered to addressees because of the absence of a link with them are stored in the buffers of the centers that are still in service and are sent after the addressees' centers are restored. The messages sent in hierarchical-type automated control systems are generally intended for multiple users, and messages generally exist in more than one copy. This makes it possible to send data from several centers simultaneously under the condition that each message is sent once. This article presents a solution to the mathematical formulation of this problem. It is determined that when a system contains fewer than 8 - 10 copies it is to use an exact method of integral dynamic programming. When more copies (i.e., several dozens or hundreds) are present in the network, less exact but faster algorithms for distributing portions of one or two messages are effective. A combined scheme of subdividing messages can also be used for a wide range of numbers of copies of a single message in an automated control system. The principle of multiple backups of messages in the buffers of an automated control system's centers that is proposed in this article may be used in regional and branch automated control systems to plan the information restoration of centers after failures and during the structural reorganization of control systems. Reducing the time required to deliver information in such situations will make it possible to improve quality control and increase the survivability of automated control systems. Figures 2; tables 2; references 6: Russian.

Assessing Voice Traffic Service Quality in Networks With Packet Switching

917G0054K Kiev MEKHANIZATSIYA I AVTOMATIZATSIYA UPRAVLENIYA: NAUCHNO-PROIZVODSTVENNYY SBORNIK in Russian No 1, Jan 91 (manuscript received 10 Apr 90) pp 52-55

[Article by V. B. Nerush and A. I. Romanov, candidate of technical sciences]

UDC 621.395

[Abstract] One way of increasing the capacity of a communications network is to use the method of packet switching to service traffic of a pulse-pause nature, such as voice traffic. When packet switching is used to transmit speech, it is very important to monitor not the average delay but rather the percentage of speech packets not delivered to the receiving user within the time of admissible delay. This quantity is determined by proceeding from the fact that the delay in the transmission of speech signals between users conducting a conversation must not exceed 300 ms. Speech packets that are not transmitted completely are considered lost inasmuch as restoring the respective speech signal fragments is not feasible. Thanks to the significant redundancy of a speech signal, however, up to 7 percent of a speech packet may be lost without any noticeable distortion of the speech signal. The authors of this article propose a method of assessing the quality of voice traffic service in the branch of a network with packet switching operating in a mode of virtual connections. A network branch is looked upon as a system servicing a stream of speech packets arriving from a finite number of logic channels that are the sources of the voice traffic. The network is modeled in terms of a single-channel queuing system with a wait, with group input of a stream of requests (each request being a speech packet), and with a constant request servicing time. Using the model presented makes it possible to determine the number of speech packets in the queue to a transmission channel, the probability of loss of a speech packet, the average time the speech packet is located in the system

servicing the stream of packets, and the transmission channel's load. This information is used to derive relationships that can be implemented to determine the maximum allowable number of logic channels that may be present simultaneously in a branch. That quantity may then be used to estimate the quality indicators of the servicing of telephone calls in such networks. References 6: 4 Russian, 2 Western.

Diagnosing Line Paths of Multichannel Transmission Systems With Frequency Division of Channels

917G0054L Kiev MEKHANIZATSIYA I AVTOMATIZATSIYA UPRAVLENIYA: NAUCHNO-PROIZVODSTVENNYY SBORNIK in Russian No 1, Jan 91 (manuscript received 15 Mar 90) pp 55-57

[Article by A. N. Gorin and V. G. Ponomarev]

UDC 621.398.9

[Abstract] The plans to improve the performance of the primary network of the Unified Automated System of Communications for the USSR call for introducing an automated operations control system to collect and process the information needed to make administrative decisions and keep the network in working order. The plans also call for an automated operations and maintenance system to implement the processes of checking for, detecting, locating, and eliminating trouble in the network. Diagnosing the status of the network's line paths is especially important for ensuring that the network remains in good working order. Such monitoring requires the following: 1) continuous assessment of the operating quality of the operations monitoring equipment to detect any faults present in the equipment; 2) determination of the nature and location of a fault in order to establish its cause; and 3) performance of the required reconditioning and adjustment operations, bypasses, and replacements required to restore communications and eliminate the fault. These priority tasks can all be accomplished by using a built-in sensor for monitoring a path's serviceability and determine the nature and location of deviations arising in the line paths. This will make it possible to automate the laborious processes entailed in operating communications networks and increasing their operating efficiency. This article describes one such built-in sensor termed a device for monitoring the working signal for end points [UKRO]. It contains a channel for sensing overloads and a channel for sensing reductions in the transmission level. It is estimated that the annual savings from using 1,000 such devices to monitor line paths will amount to about 90,000 rubles, with one UKRO costing 70 rubles. Figures 1; references 5: Russian.

The Use of Computer Technology Under the New Management Conditions

917G0058A Moscow MEKHANIZATSIYA I AVTOMATIZATSIYA PROIZVODSTVA in Russian No 1, Jan 91 pp 29-30

[Article by A. I. Siverskiy, engineer, under the "Economic and Organization of Production" rubric: "The Use of Computer Technology Under the New Management Conditions"]

UDC 330.341.4:621.38

[Text] Since 1988 the Minsk affiliate of the Orgstankinprom All-Union Scientific Research Institute has been operating under conditions of cost accounting and self-finance. In accordance with the policies that the affiliate's administration has adopted regarding the brigade form of labor organization and regarding awarding bonuses based on the results of economic activity, withholdings taken from the profits obtained from scientific-technical production and transferred to the material incentives fund and wage savings (additional earnings fund) achieved by increasing labor productivity and by operating with a smaller number of personnel are the main sources of incentive to departments' collectives (brigades) for meeting plan indicators and for increasing labor efficiency. The totals awarded to collectives of brigades from the specified sources are established quarterly and distributed between brigade members in proportion to the wages of each member for time actually worked with consideration of the labor participation coefficient for the fiscal quarter. The size of the bonus (additional earnings) of each worker in a brigade is determined by using the formula

$$S_i = \frac{S \sum_{j=1}^{3} K_{ij} Z_{ij}}{\sum_{i=1}^{n} \sum_{j=1}^{3} K_{ij} Z_{ij}}, \qquad (1)$$

where S is the sum total of the bonus (additional earnings) of the brigade for the fiscal quarter in rubles, j is the ordinal number of the month in the fiscal quarter, i is the ordinal number of the worker on the list, n is the size of the brigade in persons, K_{ij} is the labor participation coefficient of the i-th worker in the j-th month of the fiscal quarter, and Z_{ij} represents the wages for the time actually worked by the i-th worker in the j-th month of the fiscal quarter.

The labor participation coefficient of a brigade member for a month is determined by using the formula

$$K_i = \frac{\sum_{i=2}^{n} K_i}{\sum_{i=2}^{n} N_i}. \qquad (2)$$

where N_i assumes the following values: 0 if, for some reason, the i-th worker has not worked for the entire calendar month or 1 if he has.

To automate the operations connected with distributing the sums of bonuses and additional earnings, in 1988 the Minsk affiliate of the Orgstankinprom All-Union Scientific Research Institute developed and installed a labor participation coefficient applications package.

The labor participation coefficient applications package was developed by using the TURBO PASCAL programming

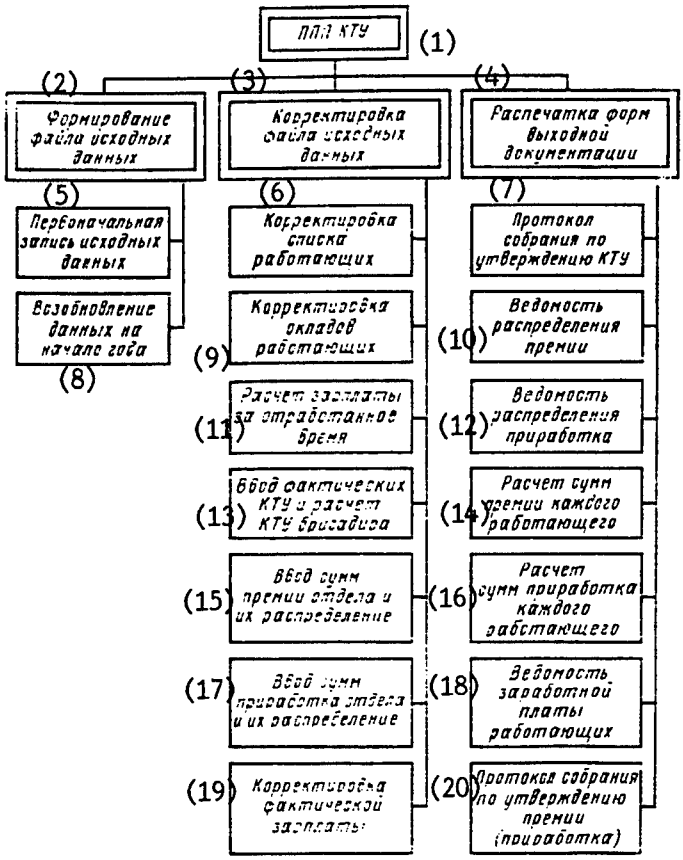

Figure 1. Block diagram of the labor participation coefficient applications package.

Key: 1. Labor participation coefficient applications package 2.Creation of the source data file 3.Correction of the source data file 4.Print out of output documentation forms 5.Initial writing of the source data 6.Correction of the list of workers 7.Collection protocol for confirmation of the labor participation coefficient 8.Updating of data at the beginning of the year 9.Correction of workers' salaries 10.Bonus distribution summary 11.Calculation of wages for time worked 12.Additional earnings distribution summary 13.Input of actual labor participation coefficients and calculation of a brigade member's labor participation coefficient 14.Calculation of the bonus totals of each worker 15.Input of department bonus totals and their distribution 16.Calculation of additional earnings totals for each worker 17.Input of departmental additional earnings totals and their distribution 18.Workers' wage summary 19.Correction of actual wages 20.Collection protocol for confirmation of a bonus (additional earnings)

system and was implemented on a YeS1840 professional PC controlled by the Alpha-DOS operating system.

Figure 1 is a block diagram of the labor participation coefficient applications package.

The required operating mode is selected from the main menu and submenus that are displayed on screen. The main menu and submenu for correcting source data files are presented as examples in Figures 2 and 3.

The creation, correction, and processing of the source data files and the printout of the processing results are all accomplished interactively.

As follows from Figure 1, two modes of creating source data files are possible: writing the source data files for the first time and updating the data base at the beginning of the year.

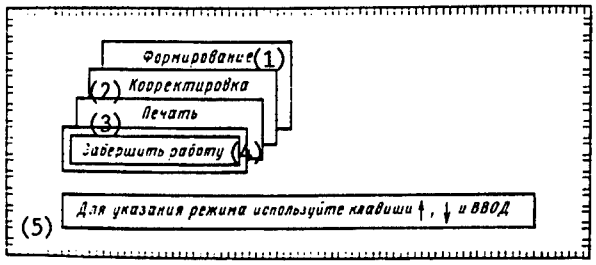

Figure 2. Main menu of the labor participation coefficient applications package.

Key: 1.Creation 2.Correction 3.Printout 4.Quit 5.Use keyboard and <enter> to select mode

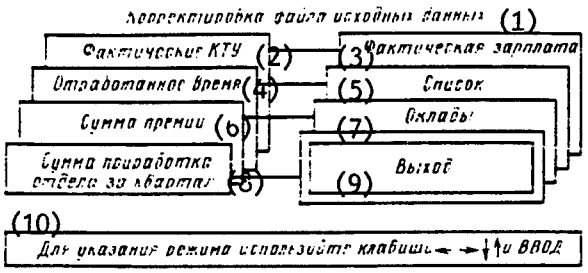

Figure 3. Submenu for correcting the source data file of the labor participation coefficient applications package.

Key: 1.Correction of the source data file 2.Actual labor participation coefficients 3.Actual wages 4.Time worked 5.List 6.Total bonus 7.Salaries 8.Total additional earnings of a department for the quarter 9.Output 10.Use keyboard and <enter> to select mode

The first mode is used when installing the applications package. In this case,the user inputs the following data in response to queries from the professional PC: department name, department number, current year, plan-stipulated work time fund for a worker by month for the current year, surname and initials of the worker, table number, and established job salary of each worker.

The second mode is used when completing all calculations for the current year. The user inputs only the year being planned and the fund of work time for each month of the planning year.

In both the first and second modes, the following data are zeroized and written on floppy disk:

—the brigade's total additional earnings and total bonuses by the four quarters of the planning year;

—the time actually worked, wages for the time actually worked, and the labor participation coefficient of each brigade member throughout all of the months of the planning year;

—the total additional earnings and bonuses for each brigade member throughout the four quarters of the planning year.

The modes on the submenu for correcting the source data files are used in making all changes in the source data files over the course of the year. This process is conducted in the following sequence.

At the end of each month, the time actually worked by each worker is input and written on floppy disk. The wage for time actually worked is then automatically calculated and written for each worker. The submenu for printing out output documentation forms is then used to print out a form entitled "Departmental Wages of the Workers of the (department name) Department for (fiscal month) of the year (fiscal year)."

At the beginning of the next fiscal month, the user inputs the labor participation coefficient that has been established for each brigade member for the fiscal month. The labor participation coefficient of each brigade member is automatically calculated in this same mode by using formula (2). The calculated and input data are written onto floppy disk. Afterwards, a document entitled "Brigade Collection Protocol for Confirmation of the Labor Participation Coefficient for (fiscal month and fiscal year)" is printed out when necessary.

At the end of a quarter the total additional earnings and bonuses for the brigade in that fiscal quarter are input and written onto floppy disk. Formula (1) is used to calculate the total additional earnings and bonuses awarded to each brigade member. These data are also written onto floppy disk. The following documents are also printed out analogously: "Calculation of Total Additional Earnings (Bonuses) for Each Worker for the (number of the fiscal quarter) Quarter of the Year (year number)" and "Summary of the Distribution of Additional Earnings (Bonuses) Between Workers of Department No. (department number) Based on the Results of Work in the (quarter number) Quarter of the Year (year number)."

If one of the brigade members has been released, transferred to another brigade, or changed name or department or if the department has received a new worker, the list of workers is corrected by using the respective mode.

The salary correction mode is used in the case where a brigade member's salary is changed.

In the event of discrepancies between the accrued and calculated wages (for example, in the case of illness), the respective mode is used to correct the actual wage.

During the process of working with the labor participation coefficient applications package it is possible to check data input from the keyboard for the presence of I/O errors. When an inadmissible character in the input process is detected or if the input data is not within the range of admissible values, an audio signal is issued, and the query is repeated. The applications package's operation is not interrupted.

To avoid the accidental loss of information when a mode is selected by mistake (for example, updating the data base at the beginning of the year or correction of the list of workers), the respective warnings regarding possible consequences are output to the display screen, and confirmation of the mode selection is requested. Other software-executed methods of protecting the source data files are provided.

During the one and a half years of its operation, the labor participation coefficient applications package has demonstrated its high reliability, efficiency, and ease of use.

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