

Listed are abstracts from recent papers by IBM authors. Inquiries should be directed to the publications cited.

Assembler-Language Macroprogramming: A Tutorial Oriented Toward the IBM 360, W. Kent, *Computing Surveys* **1**, No. 4, 183-196 (December 1969). An introduction is given to the basic concepts of macros; the usefulness of macros and how to write macro definitions (specifically in the IBM 360 Assembler language) are discussed.

Is Automatic "Folding" of Programs Efficient Enough to Displace Manual?, D. Sayre, *Communications of the ACM* **12**, No. 12, 656-660 (December 1969). The operation of "folding" a program into the available memory is discussed. Measurements by Brawn et al. and by Nelson on an automatic folding mechanism of simple design, a demand paging unit built at the IBM Research Center by Belady, Nelson, O'Neill, and others, permitting its quality to be compared with that of manual folding, are discussed, and it is shown that given some care in use the unit performs satisfactorily under the conditions tested, even though it is operating across a memory-to-storage interface with a very large speed difference. The disadvantages of prefolding, which is required when the folding is manual, are examined, and a number of the important troubles which beset computing today are shown to arise from, or be aggravated by, this source. It is concluded that a folding mechanism will probably become a normal part of most computing systems.

The Block-Oriented Language SIMANNE, von B. Zechmeister, *Elektronische Rechenanlagen* **11**, No. 2, 82-90 (1969). SIMANNE (SIMulation of ANalogical NETworks), a block-oriented language to simulate analogical networks with a digital computer, consists of a program system fully written in ALGOL. After considering block-oriented languages in general, SIMANNE is described and a simulation example is given.

Data Transmission: A Direction for Future Development, H. Rudin, Jr., *IEEE Spectrum* **7**, No. 2, 79-85 (February 1970). Despite the rapid advances in many regions of data transmission, there is a rapidly growing number of applications for which existing data-transmission techniques are inefficient. A look at the status of data-transmission development indicates that, although a very successful campaign has been waged to map the data waveform into a waveform ideally suited for transmission on the communication channel, very little has been done to match the often discontinuous flow of data from the terminal to the continuous flow of information in the channel. Combining randomly occurring messages from several sources into a more continuous flow is described by the mathematics of traffic theory. Although this theory has been extensively applied to speech traffic, it is rarely applied to data traffic. As a specific example of the gains in channel efficiency that can be had through the application of traffic theory, the multiplexer-concentrator is examined. In the author's opinion, it is in this area of application of traffic theory to data communication that many of the more significant future developments in data transmission will be made. To be sure, some work has been done, but it is relatively little when the gains that can be made are considered.

Abstracts

A Digital Control System for Nuclear Physics Laboratory, C. E. L. Gingell, M. W. Sachs, D. A. Bromley (Yale University, New Haven, Conn.), A. A. Guido, and J. Birnbaum, *IEEE Transactions on Nuclear Science NS-16*, No. 1, 165-170 (February 1969). An integrated hardware-software system for monitoring and controlling experimental equipment in nuclear structure experiments at the Yale University Wright Nuclear Structure Laboratory is described. In this system, the control and monitoring of symbolically addressed devices is multiprogrammed with other tasks. Where possible, the details of a control operation are handled by an external control unit rather than by the computer itself.

Information Systems in Perspective, J. D. Aron, *Computing Surveys* **1**, No. 4, 213-236 (December 1969). The purpose of the paper is to place "information systems in perspective," that is, to place the elements of information systems in their proper positions with respect to importance, content, and utility. An information system is intended to provide information needed by the user in the conduct of his business. Since that covers a broad set of situations, the paper is restricted to the general purpose aspects of file-oriented information systems, highlighting the trade-offs of importance to the user, the designer, the implementer, and the operator. In particular, the management information system (MIS) is discussed. In this paper, MIS is defined as "an information system which provides the manager with that information he needs to make decisions."

Integrated Microprogrammed Communication Control, A. W. Maholick and H. H. Schwarzell, *Computer Design* **8**, No. 11, 127-131 (November 1969). I/O devices are attached to most digital computer systems through channels and separate control units that perform many of the basic device-control functions, and match the different interfaces of the I/O devices to the channel interface. However, features which allow direct attachment of I/O devices without the need of channels or device control units can provide significant advantages. Such "integrated attachment" features are available with the System/360 Model 25. The I/O devices attached through these features are controllable by the same I/O instructions and command sequences used in channel-control unit operations. These attachments reduce the number of units and save floor space. Duplicate multiplexing—in the channel and again in the control units—is avoided. The use of microprograms in the attachments further reduces the unique hardware and power requirements for each different I/O device attached, while increasing flexibility and reliability. Such reduction in a small system is particularly desirable since I/O control hardware constitutes a larger portion of the total system.

A Modular Computer Sharing System, H. B. Baskin, E. B. Horowitz, R. D. Tennison, and L. E. Rittenhouse, *Communications of the ACM* **12**, No. 10, 551-559 (October 1969). An alternative approach to the design and organization of a general purpose interactive multiterminal computing system is presented. The system organization described is a conceptually simple arrangement of a bank of interchangeable computers, each of which is a memory/computer pair, that are assigned to process terminal jobs as they arrive. One of the computers serves as the master or control computer and supervises the collection and distribution of messages from and to the remote terminals. In the simplest form there is a disk drive for each connected terminal. A crosspoint switching network allows any such disk drive to be connected to any computer in the bank, under control of the

control computer. Thus, while each active terminal user "occupies" a dedicated disk drive, he may share the computer with many other terminal users in a simple manner. The ratio of users to computers is dependent on both the size and power of the machines used and the computation requirements of the particular mix of users. This system organization is inherently a simpler and therefore more reliable approach to time-sharing computers, and has the potential of a highly available system at relatively low cost. Economic configurations are possible for a range of system sizes that span at least one order of magnitude. Finally, problem programs developed by remote terminal users can be run on a dedicated batch system if compatible computers are used.

A Note on Ambiguity of Context-Free Languages and Presentations of Semilinear Sets, A. L. Rosenberg, *Journal of the Association for Computing Machinery* **17**, No. 1, 44-50 (January 1970). An investigation is made of certain quantitative and qualitative aspects of inherent ambiguity of context-free languages. Two main results are proved. The first asserts that for every integer k there are inherently k -ambiguous context-free subsets of $a^*b^*c^*$. This result is obtained as a corollary of a more general result concerning ambiguous presentations of semilinear sets. The second result asserts that inherent ambiguity can arise from the "nesting" property of context-free languages, as well as from the "pairwise matching" property.

A Processor Allocation Method for Time-Sharing, A. P. Mullery and G. C. Driscoll, *Communications of the ACM* **13**, No. 1, 10-14 (January 1970). A scheduling algorithm is proposed which is intended to minimize changes of tasks on processors and thereby reduce overhead. The algorithm also has application to more general resource allocation problems. It is implemented by means of a method for efficiently handling dynamically changing segmented lists.

Programming and Graphics Support for Infrared Thermal Plotters, A. D. Levit, *Materials Science* **26**, No. 9, 180-186 (September 1968). Programming and graphics support is essential if one hopes to raise the status of laboratory thermal plotters from a curiosity to a significant, useful tool. Computer programs have been written to aid in the development of the instrument by testing proposed techniques for data collection. It will be shown how computer programming was used in the investigation of the "one-scan calibration" hypothesis, which, if acceptable to the user, would substantially reduce the amount of time required to obtain meaningful data. Once a system has been established, computer programming can yield a feasible method for data display and interpretation. Computer programs are used to convert "raw data" into the more physically meaningful temperature versus (x, y) position from an initially established reference point in a plane. To obtain maximum insight into temperature distribution and heat flow, still another program is used to display these data in the form of isothermal contours. The benefits of this system, over other approaches, and the derived algorithm for the construction of computer-generated contour lines will be discussed. Most significantly, possible extensions of the contour program can be envisioned which may prove more exciting than the original concept. Such uses could include generation of gradient information and heat flow patterns leading to a more thorough understanding of heat transfer mechanism in microcircuitry.

Symbolic Generation of an Optimal Crout Algorithm for Sparse Systems of Linear Equations, F. G. Gustavson, W. Liniger, and R. Willoughby, *Journal of the Association for Computing Machinery* **17**, No. 1, 87-109 (January 1970). An efficient implementation of the Crout elimination method in solving large sparse systems of linear algebraic equations of arbitrary structure is described. A computer program, GNSO, by symbolic processing, generates another program, SOLVE, which represents the optimal reduced Crout algorithm in the sense that only nonzero elements are stored and operated on. The method presented is particularly powerful when a system of fixed sparseness structure must be solved repeatedly with different numerical values. In practical examples, the execution of SOLVE was observed to be typically N times as fast as that of the full Crout algorithm, where N is the order of the system.

Trends in Computer-aided Circuit Design (CACD), E. T. Johnson, *Electro-Technology* **84**, No. 5, 57-62 (November 1969). Computer-aided circuit design—introduced only a few years ago as an important new analytical tool for the development engineer—is reaching a level of maturity where many of the initial problems have been resolved or dramatically reduced. Fundamental programming improvements plus advances in graphic display and terminal techniques have resulted in faster turn-around time, ease-of-use and greater flexibility in solving a wide range of circuit analysis problems. Fortunately, these advances are occurring at a time when the impact of integrated circuits may make CACD techniques not merely useful to the engineer but rather, essential. Although many problems remain, there are good indications that significant gains in computing speeds and the ability of CACD programs to handle highly complex design problems can be expected in the near future. The author discusses these trends and their future implications in addition to reviewing the scope of the present CACD programs available for the analysis of DC, frequency response, s -plane and transient response. The role of optimization and modeling also are described.