

(Two Sessions)

**RICHARD W. HAMMING**, Chairman, Bell Telephone Laboratories*I. Session 8, Wednesday, August 31 2 p.m.**Speakers and Panelists*

**WALTER W. FINKE**  
President, Electronic Data  
Processing Division,  
Honeywell, Inc.

**EMMUEL G. MESTHENE**  
Executive Director, Program on  
Technology and Society,  
Harvard University

**ROBERT H. RYAN**  
President, Regional Industrial  
Development Corporation of  
Southwestern Pennsylvania

At the Spring Joint Computer Conference, Mr. Walter Finke charged our industry with standing aloof and disregarding the need to help society adapt to technology and to achieve the vast potential benefits which it opens to us. This session will examine that charge in the context of the report of the National Commission on Technology, Automation and Economic Progress and attempt to define the social responsibilities of the computer professional and of our industry.

*II. Session 9C, Wednesday, August 31 4 p.m.**Additional Panelists*

**PAUL ARMER**, The RAND Corporation  
Chairman-Elect, American Federation of Information Processing Societies  
**EDMUND C. BERKELEY**, Berkeley Enterprises, Inc.  
**ANTHONY G. OETTINGER**, Harvard University  
President, Association for Computing Machinery  
**RICHARD L. TANAKA**, California Computer Products, Inc.

Continuing the earlier session, the above commentators will join the previous speakers to discuss the far-reaching effects of automation and advancing technology on our society.

## CONTRIBUTED PAPERS

*TUESDAY, AUGUST 30: SESSIONS 3A, 3B, 3C 2-3:30 P.M.; 4A, 4B, 4C, 4-5:30 P.M.**Session 3A 2:00 p.m.***RECENT DEVELOPMENTS  
IN COMPUTER SCIENCE CURRICULUM**

**WILLIAM E. ATCHISON**, Chairman  
Georgia Institute of Technology

Computer Science Curriculum at this point in time is very rapidly developing both at the high school level and at the college level. One part of a panel discussion will bring out recent developments in the use of computers in high school, particularly as they are being used in conjunction with mathematics courses. Considerable materials along these lines have been developed by the School Mathematics Study Group (SMSG) and will be reported by T. A. Keenan.

The ACM Curriculum Committee on Computer Science (C S) has been working on the development of Computer Science Curriculum at the college level, since the publication of its Preliminary Report in the September 1965 issue of the *Communications of the ACM*. This group has National Science Foundation support and has been working extensively to develop a new curriculum report which takes into consideration recent developments. S. Conte will report on the progress.

The Committee on Computer Science in Electrical Engineering Education (COSINE) has been working on course materials for Computer Science within Electrical Engineering and will report on this.

**Computer Science in High School Mathematics**, **ELLIOTT I. ORGANICK**, University of Houston, **THOMAS A. KEENAN**, University of Rochester, **SYLVIA CHARP**, School District of Philadelphia, and **ALEXANDRA FORSYTHE**, Gunn High School, Palo Alto, California.

A report will be presented on the content, philosophy and use of a preliminary edition of a text on computing for use in a 12th grade course in mathematics, entitled "Algorithms, Computation and Mathematics." The text, prepared by the School Mathematics Study Group (SMSG), deals chiefly with the nature of digital computers, algorithmic concepts of numerical and non-numerical problem solving and related mathematics.

A summary of the actual experience gained in the use of the text will be given at the oral presentation of the paper.

*Session 3B 2:00 p.m.***COMPUTER/COMMUNICATION SYSTEMS FOR BUSINESS**

**WALTER F. BAUER**, Chairman  
Informatics, Inc.

*Panelists:*

**ROBERT GRISETTI**, Western Union Telegraph Company  
**HERBERT MITCHELL**, Bunker-Ramo Corporation  
**JOHN W. WEIL**, General Electric Company  
**L. E. DONAGAN**, IBM Corporation

The panel members will discuss information handling systems which are characterized principally by large scale communication networks and large scale data bases. Frequently, the systems are further characterized by the large number of user stations, each having access to the centralized data base. Although time sharing is present here as a technical characteristic, these systems are different from the general purpose time sharing systems which have received so much publicity. For one thing, these systems usually imply more of a custom-tailored capability very powerful to the intended application. These systems very often develop, in an evolutionary way, from computer-implemented communication systems, such as conventional message switching systems and become, with the development of more data processing capability at the node points, a communications-oriented multicomputer system. It is the consensus among many professionals that such ultra large scale systems will evolve—many taking the form of public information utilities and others taking the form of large scale private systems for business, with frequent interconnections among the private and public systems. An important implication for business is that centralized data bases and, therefore, centralized control of business and administrative operations are possible with concomitant increased efficiencies and cost savings.

The panel members will discuss the various technical and management problems associated with these systems. They will cover topics such as the adequacy of hardware, the cost and quality of software, the role of the computer manufacturer, the role of the common carrier, file security, and various potential legal problems.

*Session 3C 2:00 p.m.*

#### **NUMERICAL ANALYSIS**

**SAMUEL D. CONTE**, Chairman  
Purdue University

The papers in this session definitely reflect the influence of the computer on numerical analysis. The first paper presents a promising new algorithm for the general matrix eigenvalue problem. The second paper presents an efficient technique for finding the eigenvalues of matrix polynomial equations. The third paper compares the efficiencies and accuracy of direct vs. iterative methods for solving a class of biharmonic difference equations. The fourth paper presents a unified treatment of a class of Newton-like methods for finding the roots of non-linear systems of equations.

The last two papers are concerned with what might be called "Automatic Numerical Analysis." They both require the development of a programming system and a problem-oriented language to allow the user to apply fairly sophisticated techniques of numerical analysis to solve his problems in an online conversational system. These two papers may be considered the forerunners of a considerably expanded effort in the area of automatic numerical analysis.

**Convergence of the Q-R Algorithm for Hessenberg Matrices**,  
**BERESFORD PARLETT**, University of California.

Algorithms are sought to transform a given matrix by similarities into a form which reveals their eigenvalues. The **Q-R** algorithm is usually applied to Hessenberg matrices. Using this fact as a hypothesis a complete convergence theory for the algorithm has been obtained. It happens that the one phenomenon which prevents the essential convergence of the basic algorithm may be removed by a suitable shift of origin.

**A New Solution Method for the Determinantal Equation of a Matrix Polynomial**, **C. D. ISAACS** and **J. E. STENGLE**, Boeing Company.

Some of the methods used for finding the roots of the determinantal equations of a matrix polynomial will be given and the weaknesses of each method will be analyzed.

A different approach, using basic theories from differential equations to transfer the problem into a standard eigenvalue problem, will be **discussed**. Two sample transformations will be presented, the advantages gained by one transformation over the other indicated. Some reasons will be given for the selection of the Q-R Transformation over other methods to eigenvalue solution and the Q-R Transformation will be reviewed briefly to validate the reasoning.

A computer program using the new approach in conjunction with the Q-R Transformation will be compared with other computer programs using older published methods, to reveal many definite advantages of the new method.

**Iterative vs. a Direct Method for Solving Fourth Order Elliptic Difference Equations**, **LOUIS W. EHRLICH**, Johns Hopkins University.

Direct methods have been recommended for solving large space linear systems when, among other reasons, the systems are ill-conditioned. It is the author's contention that, in general, biharmonic-type equations lead to linear systems which fit into this category: A direct method, applicable to large block tridiagonal linear systems, is compared with an iterative method, the 2-line SOR method. Using the biharmonic equation in a square as a model, it is shown that the direct method is competitive in the number of arithmetic operations involved. A rounding-error analysis indicates there is no reason to suppose the errors in the iterative method are less than those of the direct method.

**A Review of Quasi-Newton Methods in Nonlinear Equation Solving and Unconstrained Optimization**, **EDWARD M. ROSEN**, Monsanto Company.

A class of methods related to the Newton-Raphson and general secant approximation method for solving sets of nonlinear simultaneous algebraic equations and unconstrained optimization problems will be reviewed. The class of methods is attractive in that it requires no derivative evaluations of the functions but approximates them by a series of secant approximations. The close relationship that exists between the proposed nonlinear equation-solving algorithms and the unconstrained optimization method of Fletcher and Powell will be shown and some of the computational aspects of the class of methods will be discussed. The flexibility and generality of the class of methods will be emphasized.

**Numerical Integration in Ordinary Differential Equations Operating under ILLIAC II Time-Sharing System**, **C. W. GEAR**, University of Illinois.

The results will be described as obtained to date from the design and use of a numerical integration subsystem for initial value problems in ordinary differential equations, which operates under the University of Illinois ILLIAC II time sharing system. The purpose of this subsystem is to allow the integration of systems of differential equations, not necessarily of first order, directly from a symbolic statement of the equations and to make use of the presence of the human originator of the problem to provide information when the numerical method "gets into trouble." The utility of an analog computer which allows rapid modification of the equations is provided, with the advantage that digital techniques allow for high accuracy to be obtained when needed.

**NAPSS—A Numerical Analysis Problem-Solving System, JOHN R. RICE and SAUL ROSEN, Purdue University.**

It has long been a recognized goal of computer programming technology to permit problems to be stated in languages appropriate to the fields in which the problems exist, and to provide for the solution of such problems as stated without requiring the services of specially trained programmers and analysts. Systems that provide these capabilities are "problem solving systems." Their languages are problem-oriented languages.

At Purdue University during the past year work has been under way on a design for a Numerical Analysis Problem Solving System (NAPSS). Some of the features of the language and system design will be presented, and an approach through the development of so-called polyalgorithms to the design of the Numerical Analysis packages that are the essential elements of the problem solving system will be offered.

*Session 4A 4:00 p.m.*

### **A 3-RING TUTORIAL**

ROBERT W. RECTOR, Chairman  
Informatics, Inc.

The papers presented in this session review the current work in three important fields for those wishing to become familiar with recent advances and thus broaden their horizons.

**Computer-Assisted Instruction : Specification of Attributes for CAI Programs and Programmers, GLORIA M. SILVERN and LEONARD C. SILVERN, Education and Training Consultants, Los Angeles.**

A brief review of programmed instruction and teaching machine technology will be presented as an introduction to Computer-Assisted Instruction (CAI).

CAI will be defined and illustrations given of non-CAI applications of computers in educational environments. A learner's view of CAI will be given, followed by a teacher's view.

Considerable discussion will be devoted to the role of the instructional programmer, a newly emerging occupation. Activities performed by the computer programmer are delineated and the function of the computer operator in a CAI system is identified. I/O devices and trends in improving the learner/computer interface are outlined.

General specifications for a CAI compiler will be presented. The future of CAI will be viewed in terms of six major problem areas, and these will be identified and analyzed in detail.

**A New Classification Theory Leading to Automatic Pattern Recognition, ORRIN E. TAULBEE and JOHN T. WELCH, JR., Goodyear Aerospace Corp., Akron, Ohio.**

More recently, classification theories have been applied to the problem of pattern recognition and the authors have developed a classification technique, called coherence classification, which is designed to automate and upgrade the classification process. The theory, as developed, is perfectly general in that it classifies items, whether they be documents, signals, photographs, etc. Significant features of the technique are that it is (1) objective, (2) easy to update, (3) automatic and (4) independent of item representation.

An application will be made to the identification of aerial photographs. A simple criteria of association is used as a

measure of similarity between selected parameters of the signals generated by a flying spot scanner. The coherence classification technique is then applied and the source of the signals is identified.

**Aspects and Applications of Symbol Manipulation, BERTRAM RAPHAEL, Stanford Research Institute.**

Some definitions of basic concepts in symbol manipulation will be presented, as well as some examples of applications of symbol manipulation. Symbol manipulation is "the set of processes and techniques useful for nonarithmetic computation." Lists, list structures, strings, trees, numbers of arrays are common forms of symbolic data. List processing and string processing are sets of techniques for manipulating certain kinds of data structures.

Other symbol-manipulation techniques include tree manipulation, hash coding and array manipulation. Examples of research and application areas will be presented for which these techniques have been used. These areas include artificial intelligence, linguistic data processing, simulation, picture processing, man/machine systems and programming language development.

*Session 4B 4:00 p.m.*

### **FILE MANAGEMENT**

JOHN A. POSTELY, Chairman  
Informatics, Inc.

The continuing trend toward increasing complexity in computer programs underlies the development of generalized software. Still in the early stages of its development, the technology of generalized software frequently involves the use of large files. The discussants on this panel will describe some approaches to producing working systems in a variety of contexts, each with its own special objectives and constraints both for the system developer and the ultimate user.

**Design of a Multi-Level File Management System, E. W. VERHOEF, Informatics, Inc.**

A file system will be described which is part of a multi-computer system also containing a variety of secondary storage devices. The user organizes his data by whatever method he desires into fixed length blocks, the length of which is standard throughout the system. The file system provides the means for storing hierarchically organized blocks in such a fashion that the more active material resides on fast access devices and the less active on slow access devices.

The storage assignments are determined by the system on a statistical basis and reviewed periodically by the system to determine whether they are still valid. The user can temporarily over-ride this assignment for the duration of his run if he requires faster access than that afforded by the system's automatic assignment. Provision is made for the user to refer to his blocks both symbolically and/or sequentially.

**An Information System for the Coordination of Program Design, L. BERNSTEIN, F. E. SLOJKOWSKI, Bell Telephone Laboratories.**

An information system, called the Program Management System, has been developed to be used by program designers on large program development projects to effect greater coordination of their development activities. The users store actual design documentation in the system. The documents are cross-referenced internally to reflect both the structure of the program system being designed and the personnel organization performing design. This referencing scheme

per weaknesses in coordination to be detected as design incon- ences, and vice versa. It also allows project managers to have ready access to over-all project information.

A standard "fill-in" documentation form is used for all system input. The system is divided into two major subsystems. The storage and retrieval subsystem transforms input documents into an internal file/subfile structure, creates links between the files and retrieves subfiles for processing. The information processing subsystem operates on subfile information, performing information editing.

**GIS: Its Capabilities and Application**, J. H. BRYANT AND P. SEM E, JR., Informatics, Inc.

GIS, an acronym for IBM's recently announced "Generalized Information System," permits a new approach to a large scale system implementation. The related techniques are illustrated with short, conceptually-oriented examples consistent with the April 1967 availability date of GIS.

*Session 4 c 4 :00 p.m.*

## **COMPUTER SIMULATION : ORGANIZATION AND FORM**

**MARTIN GREENBERGER**, Chairman  
Massachusetts Institute of Technology

The first two papers are interesting and representative examples of current simulation work. One is relevant to the space problem. Both give careful consideration to matters of flexible organization and generalized design, but neither seeks assistance from existing simulation languages. The third paper describes a system for online simulation that grew up and operates within a general-purpose time-sharing environment. The system is related to existing simulation languages, while offering a great number of interactive capabilities.

In a panel discussion concluding the session, the authors will be joined by ambassadors of several simulation languages in a give-and-take on questions of organization and form.

**Functional Design of a Generalized Vehicle Flight Simulation Program**, VILAS D. HENDERSON, Logicon, Inc.

The design features of a generalized digital computer program for the simulation of vehicle flight dynamics will be presented. This design can accommodate radical changes in mission profiles and vehicle configurations while maintaining Computational efficiency.

The structure of the program is modular with each module assigned a major simulation function. Modules are very nearly autonomous software units in the total simulation

program. A set of models are subservient to each module, providing a flexible and efficient means of performing a module's function in a variety of ways.

Special attention is given to the organization of this program into a set of functional units which have significance with respect to flight dynamics.

It is significant that a structure and organization of a generalized vehicle flight simulation program can be created which is largely independent of mission profiles and vehicle configurations, resulting in a software analysis tool which can be rapidly readied for any of the specific trajectory computation problems which presently confront the analyst.

**A Digital Simulation Model of a Freeway Diamond Interchange**, EMANUEL HAYES, System Development Corporation.

The Vehicular Traffic Study Project at System Development Corporation has developed a digital computer simulation model of a portion of a freeway diamond interchange. The total model will be used to conduct research promoting the improvement of the geometric designs of freeway interchanges and to develop effective control devices regulating traffic flow through them.

An outline will be given on the four phases of the study being conducted, and a description of the first phase, or Model 1, which has been formulated and coded for a digital computer. The programming components of Model 1 are given, together with the various outputs produced by the data reduction routines. Future directions to be taken in this study will be indicated.

**Online Simulation in the OPS System**, **MARTIN GREENBERGER AND MALCOLM M. JONES**, Massachusetts Institute of Technology.

The OPS system, an interactive system designed for use in a time sharing environment, includes an online simulation capability. A simulation activity, thought of as an event, is scheduled, canceled, or rescheduled dynamically on the AGENDA, either at a specified time, or when a prescribed condition is met. The activity can be made to consume simulated time by means of an internal *delay* for a certain period, or a wait until given conditions are satisfied. The AGENDA is a time-ordered list of all conditionally and unconditionally scheduled activities. The user may inspect it at any point in a simulation, and personally modify or restructure it. He may base his strategy on data and partial results examined and analyzed with the help of the OPS system during interruption of the run. Extensive tracing facilities permit the user to follow the flow of control during a simulation to any level of detail.

**WEDNESDAY, AUGUST 31: SESSIONS 5A, 5B, 5C, 8:30-10 A.M.; 6A, 6B, 6C, 10:30-12 A.M.; 9A, 9B, 9C, 4-5:30 P.M.**

*Session 5A 8:30 a.m.*

## **TIME SHARED SCHEDULING**

**JOSEPH W. SMITH**, Chairman  
The RAND Corporation

The dynamic nature of the time-shared environment has introduced new problems for efficient system operation while still satisfying user demands. In particular, the questions of system loading and conversational responsiveness are producing various algorithms which attempt to satisfy the operational requirements for online, time-shared systems. Some statistical evidence has been gathered for further insight

into the problem of properly regulating a time-shared system at both the internal and external levels. In addition, theoretical scheduling structures have been devised for the mechanics of flexible control and for ascertaining satisfactory system loading. The scheduling problem is far from being resolved to everyone's satisfaction and a panel of knowledgeable critics will bring the basic issues contained in the technical papers to the surface.

**The Langley Remote Computing Terminal System: Implementation and First Year's Operation**, **ROGER V. BUTLER**, National Aeronautics and Space Administration.

A remote terminal system designed to provide open shop programmers access to an IBM 7040-7094 Direct Coupled System has been in service at the NASA Langley Research Center since April 1965. Each of the twelve terminals consists of a 15 character-per-second card reader and typewriter. This paper briefly traces the development of open shop programming at the Center which led to the implementation of the terminal system and gives a functional description of the computing system as it relates to the terminal user. A more detailed discussion is given of the experience gained in implementing and managing the system.

**Operational Management of Time-Sharing Systems, RICHARD R. LINDE AND PAUL E. CHANEY**, System Development Corporation.

The authors will describe the Manager program, a set of control techniques developed to provide the computer operator with the means for managing the System Development Corporation's Time-Sharing System. The approach of the SDC system will be reviewed. Some system management techniques used will be contrasted with those at other large time-sharing installations throughout the country. The operation of the Manager program will be described briefly. Visual displays that are a part of the program will be used to illustrate the description of program use.

**A Real Time Priority Scheduler, KARL RAMSAY AND JON C. STRAUSS**, Electronic Associates, Inc. and Carnegie Institute of Technology.

The basic design elements of the EAT 8400 monitor are abstracted and presented as an integrated system for the scheduling of real time demands for service. This scheduler design includes the multiuser core-share scheduling situation.

The system design is particularly simple and has proved itself to be an efficient medium for the scheduling of a real time hybrid simulation intermixed with normal batch operation of a digital computer.

Extensions are drawn to the general multiuser time-sharing situation.

**A Terminal Operated Production Program (1'01'1') System, R. HEDGER, A. G. PONTIUS, J. M. SEEHOF, G. BENSON**, International Business Machines Corp.

An effective IBM 1050/7090 terminal system will be described that allows remote execution of library programs (mathematical analysis, information retrieval, engineering design) utilizing the full capability of the IBM 7090. High efficiency is obtained by time-sharing the terminal I/O data transmission and library tape positioning with normal IBSYS background activity. Programs with limited input and output volume, written under IJOB (FORTRAN IV, COBOL, MAP) can be readily adapted for terminal use. System applications, philosophy and limitations will be discussed.

*Session 5B 8:30 a.m.*

## BUSINESS DATA PROCESSING

SOLOMON L. POLLACK, Chairman  
North American Aviation Inc.

This session will cover several important aspects of business data processing. For those preparing to expand their computerized real-time systems, a paper describing the analysis of real-time systems will be presented. This will be followed by a description of an economical electronic point-of-

sale/updating system. Then to assist those preparing to acquire computer equipment, a description of a computer program capable of optimizing organizational physical positioning (layout) will be given. Finally, as a guide for those responsible for managing EDP resources, the last speaker will discuss management controls for effective and profitable use of EDP resources.

**Analyzing a Real-Time System, ALLEN WEINGARTEN**, International Telephone and Telegraph Co.

An approach to real-time work which focuses upon analysis will be presented. Such an approach can have vast implications. For relevant analysis can supply the key to real-time design, programming and planning. It can be used to redirect design approaches yielding gains of large orders of magnitude. Moreover, it is imperative that the focus of real-time work be placed upon analysis in order to remove the likelihood of the complete wastage of systems.

**An Economical Electronic Point-of-Sale/Updating System, DAVID G. HAMMEL**, Raytheon Company.

A major trend in the business world is toward more complete recordkeeping of business performance. The demands of government (federal, state and municipal) are ever increasing for purposes of tax evaluations. In addition, business executives are interested in obtaining more complete information, within the shortest delay period, pertaining to their company's financial operations.

For the past half century one of the basic tools used in businesses to record transaction data is the cash register. Throughout these years, the cash register has kept pace with the times, offering improved features to meet the business demands. However, this mechanical device has serious inherent limitations in its totalling and counting capabilities and its means of communicating with data processing systems.

To meet the increasing demands of business, point-of-sale systems are being designed electronically. The organization and performance of one of these systems, termed the Transaction Data System, will be the subject of this paper. A summary of the system's main features will be given.

**Automated Facilities Layout Program, J. SEEHOF, W. EVANS, J. FRIEDERICHIS, J. QUICLEY**, IBM Corporation.

An IBM 7090/1401/CalComp computer program has been developed which is capable of optimizing organizational physical positioning (layout). The "organizational unit" is not restricted and may be a department, machining area, chemical lab, individual person, piece of equipment, etc. Results are produced in graphical form for the designer. The primary applications for this program are layouts of: a manufacturing floor by functional units with the preference table responding to work flow, materials flow, utility usage, overlapping machine usage, etc.

**Management Controls For Effective and Profitable Use of EDP Resources, ROBERT M. ANDERSON**, Librascope, Inc.

There is a very real need for more emphasis on management competence in controlling edp resources assigned to a computer facility. The tendency of technically-oriented people to be enamored with the elegance and sophistication of hardware and software frequently overshadows the equally important aspect of good edp management.

One particular edp management control technique is directed toward the planning, scheduling and monitoring of those efforts associated with analysis and programming. This will be presented as a case study describing the technique used by Librascope Group of General Precision, Inc.

## UNDERGRADUATE STUDENT PAPERS

JAMES R. OLIVER, Chairman  
University of Southwestern Louisiana

The Committee of the ACM on Student Membership and Student Chapters conducted a contest for undergraduate papers among the student membership. Papers to be presented were judged best by the reviewers. The prize-winning manuscript will be awarded a \$100 prize at the Conference; the prize has been offered by the chapters in the ACM South-eastern Region.

**A General Purpose Translation Demonstrator**, JOHN D. SYBALSKY, Spackenkill Junior H.S., Poughkeepsie, N.Y.

**Mathematical Rigor—A Prerequisite for Numerical Analysis?** SHIRLEY LISS, Marygrove College, Detroit, Mich.

**Almost-Alike Programs**, ROBERT N. CHANNON, Carnegie Institute of Technology, Pittsburgh, Pa.

Session 6A 10:30 a.m.

PROGRAM STRUCTURES FOR  
THE MULTIPROGRAMMING ENVIRONMENT

ARTHUR M. ROSENBERG, Chairman  
Scientific Data Systems, Inc.

Early time-sharing systems were required to operate programs generated for non-multiprogramming environments. As a result, inefficiencies and excessive overhead resulted from the lack of operational structure and of program communications with the operating system. It is essential that the needs of efficient multiprogramming be recognized and satisfied both by programming organizational approaches and by providing more explicit information to the operating system... This session will present various considerations in the area of program structure in order to stimulate further efforts in the direction of effective multiprogramming.

**The Analytic Design of a Dynamic Look-Ahead and Program Segmenting System for Multiprogrammed Computers**, C. V. RAMAMOORTHY, Honeywell, Inc.

Since the computer operation when viewed either as the execution of programs, instructions or logical subcommands is a discrete sequential operation, its behavior can be predicted with a degree of certainty when sufficient knowledge is available about the structure of its information flow. The analytic design of a look-ahead and program segmenting system for large multiprogrammed computers will be discussed. A graph theoretic model of the computer program is assumed and the program structure is analyzed by means of the graph connectivity considerations.

**Dynamic Program Behavior Under Paging**, GERALD H. FINE, System Development Corp., CALVIN W. JACKSON, Abacus Programming, AND PAUL V. MCISAAC, Bolt, Beranek and Newmann.

Empirical data will be presented on the dynamic behavior of programs with respect to a time-sharing paging environment. A selection of popular programs constituting a considerable fraction of the normal work load on the existing SDC Time-Sharing System was examined. The entire service spectrum, ranging from conversational to production-type requests, was represented by various aspects of these programs. Data were obtained by interpretive execution of the machine instructions for these programs and are presented in the form of storage maps and page-demand graphs.

The implications of this information for the efficient utilization of page-turning concepts on the next generation of time-sharing computers will be discussed.

THE NEW PARTNERSHIP—EDP AND MANAGEMENT  
VALUABLE OR VIOLENT IN THE 1970'S

ROBERT G. SCHERER, Chairman  
First Western Bank and Trust Co.

The panel discussion will be built around the following major issues: Will executive management accept and effectively utilize the new partner? Is information processing technology moving too fast for the top management team? Will organization changes be required to make this an effective and profitable partnership? How can the top EDP man improve his communications with executive management?

## Panelists:

SMITH B. DAVIS, Southern California Edison  
ROBERT HEAD, Computer Sciences Corporation  
ROBERT W. CLAYTON, Ducommun, Inc.  
HAROLD KOONTZ, University of California at Los Angeles

Session 6C 10:30 a.m.

ENGINEERING, MEDICAL  
AND SCIENTIFIC APPLICATIONS

G. H. KURY, Chairman  
Aerospace Corporation

Computer applications are presented in the fields of engineering, medicine and science. While the applications themselves are largely diverse, the computer techniques used in each field are provocatively pertinent to the other fields.

**An Approach to Speech Synthesis and Recognition: A Digital Computer**, B. V. BHIMANI, R. D. MERRILL, R. R. MITCHELL, M. R. STARK, Lockheed Missiles and Space Co.

An approach to the study of speech recognition and synthesis will be reviewed. A novel method will be discussed for the generation of phonetic representations of elementary English words from their orthographic forms that considers the treatment of variations in dialect and speech patterns. A means of extending this work to polysyllabic words of English will be outlined. Some of the difficulties in the definition of the phonetic representations of corresponding orthographic forms, and the disagreement among dictionary makers, will be discussed as possible limitations to the specification of a set of rules that can convert the English spelling, or the graphic form, into its phonetic representation. A more general method will be described. Related work on the subject of conversion of the phonetic forms of words into corresponding speech-like waves will be reviewed with references.

**Man/Machine Communications in the Biological Medical Research Environment**, W. E. FARLEY, A. H. PULIDO, T. M. MINCKLER AND L. D. CADY, University of Texas, M. D. Anderson Hospital and Tumor Institute.

The primary source of medical information available to the clinician and the research physician is the hospital patient medical record. Unfortunately, most of the information accumulated in these records is inaccessible to the researcher due to lack of available trained personnel and the associated expense of extracting it in a form suitable for statistical analysis. In recent years many methods have been designed to record and store patient information. Success of these systems is seemingly dependent on two factors: simplicity of use, and system operating cost.

Maximum utility is derived from those systems incorporating both prospective and retrospective data accumulation. Toward this goal a pilot system has been initiated at The

University of Texas M. D. Anderson Hospital and Tumor Institute which is both operationally simple and economical for the user.

By utilizing direct man-machine communication, the system may be interrogated for information on patients who underwent treatment in the past as well as current patients. Immediate plans are to expand the system to include digital editing and file maintenance of recorded analog signals from various laboratory procedures (EKG, EEG, etc.) and to incorporate a much faster transcription operation.

**Computer Aids to Medical Diagnosis-Problems and Progress, STEPHEN R. YARNALL, RICHARD A. KRONMAL,** Department of Medicine, University of Washington.

Some of the progress and problems in the general area of computer applications to medical diagnosis will be reviewed. Three main reasons to use computers as aids to diagnosis will be discussed: (1) to reduce errors; (2) to provide economy and efficiency; and (3) to provide quantitative measures of probability based on collective past experiences. The general Bayesian model for medical diagnosis will be discussed, and it is indicated that the development of a useful mathematical model for medical diagnosis is not a trivial problem, either medically or mathematically, with much collaborative work remaining to be done.

An outline for evaluating mathematical models for diagnosis will be given, imposing statistical rigor in evaluation of results. Steps which appear to be important in bringing the retrieval and computational powers of the computer into the practice of medicine will be discussed.

**A Technique for Optimizing a Function of Many Variables: Determining the Minimum Energy Configuration of a Crystal Lattice, D. R. WINNER AND L. L. MARSH,** IBM Corporation.

A technique for optimizing a function of many variables has been developed as a solution to the problem of determining the minimum energy configuration of a crystal lattice model. This facilitates a study of lattice defects and the dependent physical properties of crystalline solids. In particular, consideration is directed to a two-dimensional, close-packed lattice with an axis of symmetry, and specific point and line defects. However, the technique can readily be extended to treat more general three-dimensional lattices with other defects.

The development of this minimization technique leads to methods which should be more generally applicable in optimizing functions of many variables. Specifically, it stresses the desirability of analyzing the function to be optimized so that advantage may be taken of all its properties.

**An Approximate Solution to a Weighted Scheduling Problem with Multiple Constraints, MICHAEL S. SKAFT,** Hughes Aircraft Co.

An approximate solution to the following weighted scheduling problem with multiple constraints is considered: Given  $n$  weighted experiments of finite duration, find the schedule with the greatest total weight subject to certain constraints. These constraints include multiple repetition of any one experiment, nonsuccessive scheduling, limited experiment resources and noncontinual scheduling intervals.

The technique begins by scanning a partitioning of the available time intervals. It eliminates the trivial scheduling cases first. A function of the weight, duration and available time interval for each experiment is evaluated. Then based on this set of function values an experiment is scheduled. The process is repeated after repartitioning.

The scheduling process will be described and illustrated by a specific scheduling problem involving three experiments.

**An Engineering Simulator, GEORGE FORBES,** Litton Industries.

A description of an Engineering Simulator will outline the user's system needed to employ a digital computer as a DEA. The above-the-surface part of a simulator system set up and operating on the IBM 7040 will be described. A detailed test problem will be included, and its tabulations shown. For checking purposes, arithmetic functions are generated rather than true technical simulation. Error analysis is not included except for general statements indicating practicability for engineering use.

The system is designed primarily for ease of use by personnel familiar with differential equation descriptions of engineering problems. Secondary considerations are the expandability and flexibility of the basic system, and efficient utilization of the digital computer.

*Session 9A 4:00 p.m.*

## **SYMBOLIC PROCESSING OF SOURCE LANGUAGE PROGRAMS**

**MARK HALPERN,** Chairman  
Lockheed Missiles and Space Co.

A session so entitled is traditionally a platform for the presentation of new programming languages. It may well be indicative of a trend in software development that none of the three papers in this session will deal with a conventional programming language, and only one with the generation of coding at all—apparently there are many interesting things one can do with source language programs besides translating them into machine language. If these contributions are representative, then advanced workers are turning their attention to the application of ideas like quality control and management engineering to the production of programs.

**An Algorithm for Selecting and Sequencing Statements as a Basis for a Problem-Oriented Programming System, EUGENE D. HOMER,** New York University.

A problem-area is defined as a system consisting of a set of variables and a set of functions relating these variables: A specific problem within the problem-area is defined as a declaration of the set of variables for which values are available and a set of variables for which values are to be computed.

The algorithm presented in this paper (1) selects, from the total set of functions contained in the problem area, those which are necessary to effect the required transformation (or returns the statement that the transformation is not possible); (2) sequences the functions in executable order; and (3) produces a list of the sequenced, selected functions interspersed with input, output and housekeeping routines (i.e., a program).

A basic algorithm will be presented. Variations in the algorithm to satisfy differences in objectives will be discussed, as will be extensions of the algorithm to more complex problems.

**On the Automatic Simplification of Source-Language Programs, ELLEN R. CLARK,** System Development Corp.

Methods of simplification that can be applied to any program written in an ALGOL-like language will be described. The simplifications are based on the form of the program and the knowledge obtained by a processor without any understanding of what the program is supposed to do. These methods have been implemented in a processor called SURE, that accepts a program written in a JOVIAL dialect and outputs an equivalent JOVIAL program that may be shorter and may execute faster than the original.

TEMPER will be described and some of the problems encountered in automatic improvement at the source-language level will be discussed. Further types of automatic program improvement will be suggested.

**On an Automated Method of Symbolically Analyzing Times of Computer Programs**, PAUL HAMBURGER, The MITRE Corporation.

TEMPO, an experimental computer program to analyze execution time of computer programs, will be described. TEMPO accepts a subject program in assembly language form. It determines a block diagram for and establishes the paths and loops in the subject program. TEMPO then evaluates the times of the loops by symbolically interpreting portions of the subject program. The final result is an equation giving the subject program execution time as a function of the symbolic variables used in the program and the blocks found in analysis.

TEMPO output is intended to aid the system designer in assessing the effects of changing user load, changing computer speeds, and selected improvement of programs.

*Session 9 B 4:00 p.m.*

#### DEVELOPMENT IN FILE MANIPULATION TECHNIQUES

CHARLES BACHMAN, Chairman  
General Electric Co.

Three different aspects of data processing will be described dealing with experiments in sorting, report generation, and the use of a small auxiliary association memory to assist in the processing of a large data base. The sorting study deals with a technique to optimize the sorting of data with a non-uniform distribution of keys. The report extract technique describes the use of a program generator written in COBOL which in turn generates COBOL statements for compilation and execution. The associative memory study shows the effects of configuration, response store, and load/unload requirements upon the performance of a data processing system.

**THURSDAY, SEPTEMBER 1: SESSIONS 11A, 11B, 11C, 10:30-12 A.M.; 13A, 13B, 13C, 2-3 P.M.**

*Session 11 A 10:30 a.m.*

#### COMPILING TECHNIQUES

THOMAS E. CHEATHAM, Chairman  
Computer Associates, Inc.

The session on Compiling Techniques will contain three most interesting papers concerned with various aspects of programming languages and their compiling.

**The Construction of Recognizers**, A. E. ROBERTS, JR., Department of Defense.

The construction of recognizers for context-free (CF) phrase structure languages is considered. An algorithmic Process is developed which can be provided with an arbitrary set of CF grammar rules. The process then produces the structure (i.e., transition table entries for input symbol-internal state pairs) for a (special-purpose) recognizer which can recognize finite strings in the corresponding CF language.

Special cases for which the recognizer is a finite-state machine will be demonstrated. For the general case a particular form of pushdown recognizer will be presented and shown to be sufficient.

**Non-Uniform Key Distribution and Address Calculation Sorting**, MICHAEL E. TARTER AND RICHARD A. KRONMAL, University of Michigan.

The total expected number of comparisons necessary after insertion of keys into the file is generalized to apply to non-uniform key distributions. The cumulative polygon address calculation algorithm is considered. The generalization is exhibited for the case of keys addressed with an arbitrary number of segments.

Two variations of the cumulative polygon address calculation algorithm will be considered. Several applications of the general results will be given.

**A Generalized Random Extract Device**, JOSEPH A. HEINER, JR. AND REED O. LEISHMAN, Thiokol Chemical Corp.

In all data processing operations, information must be extracted from historical data files. Normally, when new or different information is required from an existing file, a new computer program must be developed and checked out. This process is extremely time consuming and costly. To extract, sort and report this information in a timely manner, Thiokol Chemical Corporation's Wasatch Division is currently using the Generalized Random Extract Device (GRED).

GRED is a set of general purpose, digital computer programs designed to extract and print selected records from magnetic tape files. The GRED system is written in the COBOL language. The methods used in GRED will be presented.

**A Study of the Utility of a Hybrid Associative Processor**, J. A. DUGAN, R. S. GREEN, J. MINKER AND W. E. SHINDLE, Auerbach Corp.

The effectiveness of a small associative memory added to a data processing system will be very largely a function of three major factors: configuration, response store, and load/unload requirements. Observations will be presented based on a study of the use of an associative memory in a large non-trivial data storage and retrieval problem, in which these three variables were shown to be of basic importance. Comments will also be made on programming considerations of interest.

**State Table Analysis of Programs in an ALGOL-Like Language**, DAVID L. PARNAS, Carnegie Institute of Technology.

Discussion will concentrate on techniques used in a translator which will produce the state table of a finite state algorithm described in an ALGOL-like language. A variety of applications for such tables will be explored. It is to be expected that the availability of an easy method for obtaining state tables may stimulate the development of further applications. It is also suggested that the availability of an extended ALGOL-to-ALGOL translation system, provided as an additional alternative to the compiler-compiler, would be useful in furthering the study of programming languages.

**A Proposal for Definitions in ALGOL**, B. A. GALLER AND A. J. PERLIS, University of Michigan and Mathematisch Centrum, Amsterdam.

An extension to ALGOL will be proposed for adding new data types and operators to the language. Definitions may occur in any block heading and terminate with the block. They are an integral part of the program and are not fixed in the language. Even the behavior of existing operators may be redefined. The processing of text containing defined contexts



features a "replacement rule" that eliminates unnecessary iterations and temporary storage. Examples of definition sets are given for real and complex matrices, complex numbers, file processing and list manipulation.

*Session 11 B 10 :30 a.m.*

### **CUSTOM DESIGN OF A DIGITAL SYSTEM— SOME CASE HISTORIES**

**JOHN C. ALRICH**, Chairman  
Compata, Inc.

Although the design of a central data processor is a complex process, the technical literature has treated the subject exhaustively and it appears that the art of computer design is now becoming a discipline while still approaching its adolescence. Given a set of boundary conditions with which to interface the real world and a complete set of elements to be connected together to satisfy these conditions, it is possible, in principle at least, to methodically synthesize a computer by following a set of organized procedures. However, in extending the problem by making the data processor and its associated software an element of a system, the formalized design procedures generally are replaced by the intuition, judgment and experience of the designer. In the following papers the authors will describe three real-time systems whose complexity is such that the latter design procedure was most appropriate.

**Design of the Real-Time Executive for the Univac 418 System**, **JOHN MICHAEL WILLIAMS**, Sperry Rand Corporation Univac Division.

After a brief opening description of 418 hardware, the history and objectives to be met by the 418 systems will be introduced in their role of influencing EXEC design. The design criteria will be presented in detail, including delivery schedules, contractual design commitments, modularity in size and function, and efficiency. The influence of previous or concurrent UNIVAC efforts in executive system development will be related.

**A Special Purpose Multiprogramming System for a Computer-Controlled Telemetry Data Reduction System**, **HAROLD R. GILLETTE**, Computer Usage Development Corp.

A brief description will be given of the hardware and software making up a special purpose, multiprogrammed computer system for the real-time control of telemetry data reduction equipment. The system program will be developed in two parts, consisting of a set of library procedures for use by telemetry data retrieval activities one phase of which executes in real-time, and of an executive monitor system designed to support the real-time telemetry activity, processor-shared with background execution of a standard data processing job.

**Lunar Orbiter Command and Telemetry Data Handling System (CTDH) at Deep Space Stations**, **I. HOLGERSEN**, **E. KNUTSON** AND **D. R. MERRILL**, The Boeing Co.

The On-Site CTDH System is a real time computing system and is in the direct data flow between the spacecraft and the Space Flight Operations Facility. The problem definition, program design, timing and storage analysis and testing will be discussed.

*Session 11C 10 :30 a.m.*

### **STATISTICS IN NUMERICAL ANALYSIS**

**R. W. HAMMING**, Chairman  
Bell Telephone Laboratories

Not only does modern statistics use computers extensively, but computing has increasing need of statistics in many forms. This session shows some of the many uses of statistics that arise in using computers.

**Digital Generation of Continuous Filtered Gaussian Noise**, **K. E. TIERNAN** AND **R. G. DIETRICH**, Raytheon Co.

An efficient digital technique has been obtained for generating a continuous Gaussian random waveform with a certain restricted power density spectrum. The technique requires the generation of a train of Poisson distributed, equally likely positive or negative impulse responses of the noise filter, and summing over all the previously occurring impulse responses in the train. By taking advantage of certain properties of the impulse response of a filter containing separate real and/or complex poles, only one impulse response need be evaluated for each noise sample. This gives rise to an extremely fast digital noise generation technique which does not require a fixed sampling interval and can therefore be used with variable step-size integration procedures.

**Error Probability in Decision Functions for Character Recognition**, **J. T. CHU** AND **J. C. CHUEH**, Moore School of Electrical Engineering, University of Pennsylvania.

Upper bounds for the error probability of a Bayes decision function have been derived in terms of the differences among the probability distributions of the features used in character recognition. Applications to feature selection and error reduction will be discussed. It is shown that if 3 sufficient number of well-selected features is used, the error probability can be made arbitrarily small.

**Multinomial Acceptance Sampling**, **CLIFFORD J. MALONEY**, National Institutes of Health.

Acceptance sampling plans for the control of quality of production are divided into two broad categories. In "inspection by variables," even when the characteristic of inference is the proportion above or below some fixed quality level, the number of items which must be measured is minimal. In so-called "inspection by attributes" the items in the sample are directly tested as above or below the critical level. This procedure is frequently used even though at times many more items require examination. An intermediate procedure involving classification into severity grades requires heavy calculation, which however is well adapted to a computer. A program designed for this purpose will be described.

**A Real-Time Error Correcting Data Transmission System Treated as a Markov Process**, **FRANK T. KUHN**, Computing and Software, Inc.

When requirements for real-time data transmission systems include error detection and block retransmission capabilities, the existence of some form of buffer storage unit between the uncontrolled data source and the transmitting terminal is implied. This presentation is the result of an effort to determine optimum storage capacity for a real time system upon the basis of known transmission link error statistics and transmission rates.

A mathematical model of a general real-time transmission network with error detection-retransmission capabilities will be presented and a practical algorithm for determination of optimum storage capacity will be developed.

## PROGRAMMING LANGUAGES FOR SYMBOLIC, NUMERIC AND HYBRID COMPUTATION

CHRISTOPHER J. SHAW, Chairman  
System Development Corporation

The impulse toward the development of special purpose programming languages seems to be as strong as ever, with many of the new languages being oriented toward online interaction with users who are not professional programmers. The languages described in the papers in this session reflect this trend. All three of them are online languages. META5 available through the SDC Time Sharing System, while the other two are designed for interactive, conversational programming.

The types of computation—symbolic, numeric, and hybrid—toward which these languages are specialized are quite diverse. Yet this affords us an opportunity to take a somewhat broader than usual view of programming language developments and the effects on these developments of new application areas, new classes of users, and new modes of interaction with the computer.

**META5: A Tool to Manipulate Strings of Data**, DAVID K. OPPENHEIM, Abacus Programming, AND DAN P. HAGCERTY, System Development Corp.

The META5 system is a compiler or translator-writing system consisting of a language, compiler and a pseudomachine. The design of the language and the pseudomachine were both strongly influenced by the Backus-Naur Form metalanguage.

The structure of the META5 system will be described. An informal description of the META5 language will be presented. A program written in the META5 language will be included as an example and explained. Several applications of the system will be described.

**A Hybrid-Oriented Inter-Active Language**, MARTIN L. CRAMER AND JON C. STRAUSS, Electronic Associates, Inc.

A specification will be given for an online inter-active language designed for scientists and engineers engaged in the preparation, setup, control, monitoring and execution of hybrid computations. Through the console typewriter of a small or medium scale digital computer or perhaps a remote terminal of a time-shared system, the user is given access to both the hardware and software components of the hybrid complex.

**AMTRAM, a Remote-Terminal, Conversational-Mode Computer System**, JURIS REINFELDS, L. A. FLENKER, R. N. SEITZ AND P. L. CLEM, JR., Messrs. Reinfelds, Flenker and Seitz; NASA. P. L. CLEM, JR., Northrop Space Laboratories.

The AMTRAM (Automatic Mathematical TRANslation) system combines the concept of the open-ended desk-calculator (such as the Culler-Fried system) with that of the interactive, User-oriented programming system (such as JOSS). AMTRAM permits the use of natural mathematical notation as a Programming language at the level of conventional programming languages up to the level of advanced calculus. With AMTRAM, the user can obtain immediate graphic display of intermediate and final results and he can retain his numerical results and programs for further use either as hard copy or in machine readable form.

## INFORMATION RETRIEVAL

ROBERT M. HAYES, Chairman  
University of California at Los Angeles

This session is concerned with various programs for computer-based document retrieval. The papers cover issues involved in total systems, techniques, and in theory.

**The MECCA System, a Modified List Processing Application for Library Collections**, A. L. CALVERY, W. G. CASTNER, C. I. MACDONALD AND R. E. PEERENBOOM, The Boeing Co.

The Mechanized Catalog System is a computer system which produces catalogs for books and documents using the IBM 7094. Output consists of four-sheaf catalogs, an announcement bulletin, card catalogs, and magnetic tape master files for updating and retrieval. Input is in natural language, free field format. Of particular interest is the method used for storage and manipulation of arbitrary length character strings in a fixed word-length computer. A network of internal tables is used in storing and sorting the natural word data.

**An Algorithm for Retrieving Indexed Documents and its Application**, ALLAN J. HUMPHREY AND SHELBY L. BRUMELLE, Chevron Research Co.

An algorithm will be described for retrieving indexed documents from a serial master file. The algorithm processes search questions formulated in algebraic notation. The algorithm first converts questions from their original algebraic form to Polish (i.e., parenthesis-free) notation. A recursive routine then evaluates each document using the Polish form of the question.

The efficiency of the procedure will be discussed as well as preferred strategy that should be used in formulating the original question. The application of the algorithm to two existing retrieval systems will be described briefly.

**The IBM Technical Information Retrieval Center (ITIRC) System Techniques**, SAMUEL KAUFMAN, IBM Watson Research Center.

An information retrieval system will be described, which began in 1960 as an experiment in normal English text processing, using the IBM 650. The experiment has developed into a practical operating system on IBM 7090 and IBM 1401 computers serving approximately 5000 IBM technical and engineering professionals at IBM locations throughout the United States and Europe.

**Graph Separability and Word Grouping**, A. R. MEETHAM, National Physical Laboratory, Teddington.

The information retrieval research program of the Autonomics Division of the National Physical Laboratory, Teddington, Middlesex, England, is directed primarily towards the automation of thesaurus-making. Machine indexing and retrieval of documents will then follow on straightforwardly. One difficulty which seems to have been overcome is the machine formation of natural language word groups from data about associated pairs of words.

The technique to be discussed involves the modifications of a large graph to reveal the strongly connected subgraphs, permitting an efficient partitioning of the original graph. It is thought that the method will have applications outside the field of information retrieval.

## APPLICATIONS OF COMPUTER GRAPHICS

**JOSEPH BEHAR**, Chairman

IBM Corporation

Graphic Data Processing is the key to more efficient utilization of the computer. Of the computer I/O media available today, Graphical I/O promises to be the most convenient and helpful to the designer.

Three speakers followed by a panel will address this session. The three presentations, describing applications with their associated techniques and ideas, will most assuredly aid you in your present Graphical endeavors.

The panel members, all active in Computer Graphics, will answer the following questions:

- (1) What aids (techniques, ideas, programs, special hardware) will be forthcoming within the next two years?
- (2) Do there exist gaps in the Graphics support for those companies desiring to enter this technical area?
- (3) What guidelines can be suggested to those attempting to enter the Computer Graphics area?

### *Panelists:*

J. J. **LAVICK**, McDonnell Automation Center

T. **MOFFETT**, Lockheed

H. **FREITAC**, IBM Thomas J. Watson Research Center

**Display-Oriented Computer Usage System, HAROLD S. CORBIN AND WERNER L. FRANK**, Informatics, Inc.

The Display-Oriented Computer Usage System (DOCUS) is a software system enhancing the development of online man/machine techniques for CRT console utilization. Online tools for the nonprogramming user will be described, such as a File Maintenance and Query Language and a Text Manipulation Language. For the programming user a capability for

online programming and debugging is provided through the use of FORTRAN, CODAP, and a Display Oriented Language (DOL).

The basic framework in which these user tools operate is provided by two groups of generalized function "key programs." One group of keys, the General Operating Language, gives the nonprogramming user a display manipulation, library control and system communication facility. The second groups of keys, the Procedure Implementation Language, allows the programmer to create displays and key programs which become part of a user library and which in turn can be combined online to develop more complex functions.

**A Language and Model for Computer Design, N. G. DENIL**, IBM Corporation.

Design Language I is a prototype computer-aided-design system for 3-dimensional structures. Console communication is provided to the user by a blend of written and graphical language; the user instructs the system by using a light pen to form language commands and point out geometric entities displayed on the screen. Language commands are translated, followed by the building of an internal model of the user's design. This model is accessed for views of the design. A key feature of the model is the ability to incompletely define elements and to overdefine them; the system removes redundancies and communicates their removal back to the user.

**On-Line Textile Designing, JANICE R. LOURIE, JOHN J. LORENZO AND ABEL BOMBERAULT**, IBM Corporation.

Work being done to aid the textile designer in developing fabric design and textile machinery control information will be described.

Designers may expect to be provided with computer programs incorporating many of the structural rules of textile design, giving them the ability to interact with the computer by means of graphical I/O facilities. Aesthetic decisions will normally be made by the designer.

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## "The Synthesis of Algorithmic Languages"

Alan J. Perlis, A. M. Turing Lecturer for 1966, has announced the title of his lecture to be "The Synthesis of Algorithmic Languages." In notifying the Secretary, Professor Perlis wrote :

"After a year of unceasing composition, it has been difficult to write this letter on a matter which has given me the greatest pleasure: my selection as the first Turing lecturer. It goes without saying that I accept the invitation so kindly offered by the ACM.

"To the best of my knowledge, I was never informed whether this lecture was to be technical or popular, a sober survey of the past or a pompous extrapolation into the glorious future of computing. Since the choice is evidently to be mine I will combine all four, in appropriate proportions, into a lecture entitled "The Synthesis of Algorithmic Languages." This title combines OK words in a relatively unhackneyed way! . . .

"It is a pity that this sheet of paper is so mute, for it should convey to you the green, sun-drenched, blossomy atmosphere in which this letter is written -from a terrace against whose front the waters of Lake Lugano gently lap. Thus let me conclude this letter by saying that I miss you all, . . ."

This annual lectureship award was established by ACM as one means of giving adequate recognition to outstanding persons currently in the computing and information sciences area.

Dr. Perlis will deliver his lecture at the Opening Session of ACMGG.