CACHE NEWS

News About Computers In Chemical Engineering Education.

No. 17

September 1983

WHAT IS CACHE?

CACHE is a non-profit organization whose purpose is to promote cooperation among universities, industry, and government in the development and distribution of computer-related and/or technology-based educational aids for the chemical engineering profession.

CREATION OF THE CACHE CORPORATION

During the 1960's, the rapid growth of computer technology challenged educators to develop new methods of meshing the computer with the teaching of chemical engineering. In spite of many significant contributions to program development, the transferability of computer codes, even those written in FORTRAN, was minimal. Because of the disorganized state of university-developed codes for chemical engineering, 14 chemical engineering educators met in 1969 to form the CACHE (Computer Aids for Chemical Engineering) Committee. Initially, the CACHE Committee was sponsored by the Commission on Education of the National Academy of Engineering and funded by the National Science Foundation. In 1975, after several successful projects had been completed, CACHE was incorporated as a not-for-profit corporation in Massachusetts to serve as the administrative umbrella for the consortium activities.

CACHE ACTIVITIES

All CACHE activities are staffed by volunteers, including both educators and industrial members, and coordinated by the Board of Trustees through various Task Forces. CACHE actively solicits the participation of interested individuals in the work of its on-going projects. Information on CACHE activities is regularly disseminated through CACHE News, which is published twice each year. Individual inquiries should be addressed to:

CACHE Corporation
Room 3062 MEB
Salt Lake City, Utah 84112
(801) 581-6915

CACHE TRUSTEES AND MEMBERS

CACHE NEWS

The CACHE News is published two times a year to report news of CACHE activities and other noteworthy developments of interest to chemical engineering educators. Persons who wish to be placed on the mailing list should notify CACHE at the above address. Contributions from CACHE Representatives are welcome. This issue was edited by J. D. Seader with contributions from a number of CACHE members and representatives.

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NEW CACHE INDUSTRIAL TRUSTEES

At the June 24-25, 1983, meeting of the CACHE trustees, **John Hale** of duPont was re-elected as an industrial trustee; and **Jeffrey J. Siirola** and **H. Dennis Spriggs** were elected as industrial trustees.

Dr. Siirola is currently Research Associate at the ECD Research Laboratories of Eastman Kodak Company in Kingsport, Tennessee, and a Director of the CAST Division of AIChE. He received a PhD at the University of Wisconsin, following which he spent two years with the U. S. Army Chemical Corps. In 1972, he joined Tennessee Eastman Company of Eastman Kodak. As an undergraduate student at the University of Utah, he received the A. E. Marshall Award of AIChE for the student contest problem. He is the co-author of the introductory text, Process Synthesis, and is author of a number of articles and papers in the areas of heat integration, separations sequencing, and overall process synthesis. He developed the AIDES process synthesis system. Besides synthesis, his interests include computer-aided design, non-numeric programming, data structures, artificial intelligence, and technology assessment.

Dr. Spriggs is currently Associate Director of Chemical Engineering Technology and Distribution Technology and Service within Central Engineering for Union Carbide and is an active member of the CAST Division of AIChE. He received a PhD at the University of Virginia, following which he was a professor at West Virginia University and the University of Wyoming. Before obtaining his PhD, he worked for Allied Chemical. Prior to his present assignment with Union Carbide, he was Manager of Applied Math and Computing and of Process Design Data and Thermodynamics for Union Carbide. He has managed Union Carbide's process simulator IPES.

CACHE REPRESENTATIVES' RECEPTION

In conjuction with the AIChE Diamond Jubilee Annual Meeting in Washington, DC, CACHE is holding a reception for all CACHE representatives from **5 to 7 p.m. on Wednesday, November 2, 1983, in the Edison-Farragut rooms at the Washington Hilton Hotel.** All CACHE representatives are being sent two tickets each for this event. For the reception, Peter Rony has organized a poster session on "The Selection of a Personal Computer for Undergraduate Engineers"; and from 5:45 to 6:00 p.m., Monsanto Company will officially present FLOWTRAN to CACHE for use on department computers. The status of the FLOWTRAN project will be presented.

In the poster session, faculty representatives from several different chemical engineering departments will discuss the decision process behind their university's requirement that all freshmen engineering students purchase a specific model of personal computer. For example, Professor Robert Cole, Clarkson College, will present the arguments for Clarkson's choice of the Zenith Z100 personal computer for its engineering freshmen. Peter Rony is attempting to get university representatives to present the special features of each of the following brands of personal computers:

Zenith Z100 series
IBM, PC, IBM XT, or IBM "Peanut"
DEC Rainbow or DEC Professional
Data General Desktop Generation
Apple Corporation Model X

So far, Zenith, IBM, and DEC are represented. If your university has just made a decision to require all freshmen to purchase any of the other brands, please let Peter know immediately.

IAN DOIG'S PROCESS TROUBLESHOOTING EXERCISES COMPLETED

Process Diagnostic Exercises
An Interactive Educational Computer-Based Troubleshooting Exercise

by
Professor Ian D. Doig
School of Chemical Engrg & Industrial Chemistry
The University of New South Wales
P.O. Box 1 Kensington
New South Wales Australia 2033
(Pone 663-0351)

(Article written by David M. Himmelblau)

CACHE has cooperated with Professor Doig in making his troubleshooting and diagnostic code available to chemical engineers. His program is the first to make substantial use of computer-student interaction in process fault diagnosis. Most attempts to engage in the improvement of skills in troubleshooting have let students work on their own to determine the cause of the fault(s) in the process or work via groups, but the students obtain information from the instructor by asking questions about past experiences, the results of their calculations, the results of experiments, etc. Also, usually the troubleshooting cases that are examined refer to single pieces of equipment or small collections of equipment. Often the emphasis is placed on students to work on developing a suitable strategy for solving the problem, and little effort goes into an actual solution of the problem that is realistic.

What Professor Doig has accomplished is to set up a large data base of information that represents a flowsheet for a chemical plant based on plant simulations so that the plant does not have to be simulated to produce measurements. Data are made available on demand for measurements at a large number of locations in the plant for streams such as cooling water, steam, chilled water, and other utilities. In addition, measurements can be solicited as requested by the user on all the details of valves, pumps, blowers, and so forth, as well as physical data for all components of all streams.

Upon logging onto the computer, the student is presented with a corresponding set of current routine measurements, which differ significantly in some ways from the normally expected values. Consequently, a fault exists. The student calls for additional samplings and measurements until his hypothesis concerning the causes of the fault have been accepted or rejected. Over 100 possible faults exist in the system; and the instructor, by introducing code numbers, can select one of these.

For each ad-hoc sampling and measurement ordered by the student, he or she is charged an imaginary expense. The goal is to locate and identify the fault with a minimum cost. Other features of the system that provide realistic representation of a plant include a randomly generated Gaussian distributed error that is contained in all the measured values reported.

An instructor can use the computer program to develop student troubleshooting skills, including: 1) realization that something is in error, 2) definition of the problem, 3) collection of data, 4) reaching conclusions about the data, 5) re-evaluation of the problem, 6) cycling of the analysis until the final diagnosis is complete.

Two different plants exist to be drawn on for teaching purposes:

1. A Syschem plant including a detailed section for acid absorption
2. A distillation plant

Malfunctions that can be introduced include leaks, impurities, off-specification compositions, restrictions on proper flow rates, and excessive use of utilities.

Professor Doig recommends (Chemical Engineering Education, Summer 1980, p. 130) that no more than 10 students be allocated per instructor if the whole class works on a common problem. He also suggests that real plant experience helps provide the proper type of responses to student questions.

Figures 1 and 2 show the flow sheets of the distillation plant and the equipment involved. All the other information needed is on the computer tape provided by CACHE. In addition to each plant database, there is a manual for students for each plant that can be printed out by a student on a line printer or displayed on a dumb terminal. Now for **A WORD OF WARNING:** The instructor's manual is also located on the tape. If the program is installed on your computer, either remove the file containing the instructor's manual or prevent student access to the file. All the fault codes and other key details are in the instructor's manual and must not be made available to students.

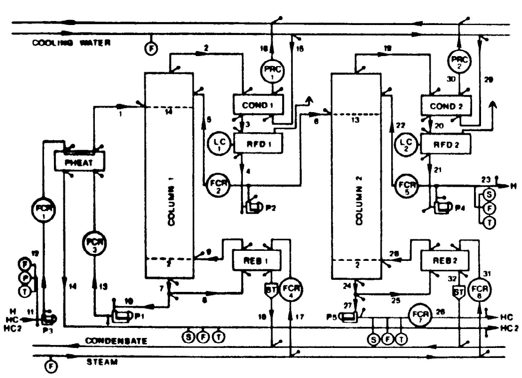

Figure 1. FLOWSHEET FOR DISTILLATION PLANT

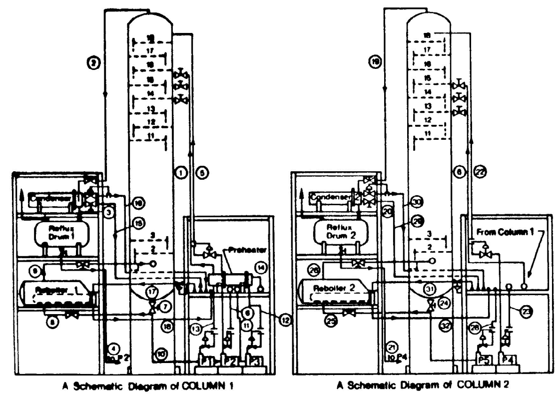

Figure 2. SCHEMATIC DIAGRAMS

CACHE has exerted considerable effort to make the computer code portable. The code has run on 1) CDC Cyber 170/750, 2) CDC-6600, 3) IBM-370/158, 4) VAX 11/780, and 5) DEC 20 computers. If you obtain the tape, list it and review the comment statements which explain the (few) changes needed to make the code compatible with one of the above computers. Coding of the program is in standard FORTRAN IV (1966), but some special features of your FORTRAN compiler may cause errors to be cited in compiling. CACHE does not support the program. Consequently, you must direct your questions about compilation errors to your computer center analysts and questions arising from the manuals or operation of the code to Professor Doig directly. CACHE would appreciate comments about education benefits and experiences using the code. If you are interested in obtaining the program on a tape, contact:

Professor D. M. Himmelblau
Dept of Chemical Engineering
The University of Texas
Austin, TX 78712
(512) 471-7445

FOCAPD-83 CONFERENCE

A total of 162 chemical engineers and other engineers and scientists attended the second conference on Fundamentals of Computer-Aided Process Design (FOCAPD-83) held June 19-24, 1983, at the Snowmass resort near Aspen, Colorado. The attendees represented 12 countries, with 84 from industry and 78 from academic institutions. The conference was sponsored by the CAST (Computing and Systems Technology) Division of AIChE, the National Science Foundation, and CACHE, with the latter being responsible for all arrangements. Professor Arthur W. Westerberg of Carnegie-Mellon University and Dr. Henry H. Chien of Monsanto Company served as conference chairman and co-chairman, respectively.

Nine successive sessions were held during a five-day period. The focus of the meeting was on the presentation of both industrial and academic viewpoints on computer-aided design, with about 90 minutes of each session devoted to discussion of issues raised by the speakers.

A limited number of copies of the proceedings of the conference will be published by CACHE late this year as a single volume. Included will be all papers and summaries of session discussions. Each attendee will receive a free copy of the proceedings. Those who were unable to attend the conference may order a copy of the proceedings from CACHE. The expected price will be $37.50 plus postage. An advance order for the proceedings may be placed by completing and submitting the form, FOCAPD-83 Proceedings, at the end of this newsletter. Additional information on the conference can be obtained by calling Vickie Jones at (801) 581-6915 in Salt Lake City, Utah.

The two-volume set (1178 pages total) of the proceedings of the first FOCAPD Conference held in 1980 is available for $40 to AIChE members from AIChE.

The program for the conference was as follows:

Keynote Address:
"Can 'Expert' Systems Solve Technological Problems?"
Speaker: Peter D. Hart
Syntelligence

Session I: "Overview and Outlook"
Chairman: Jerry L. Robertson
EXXON Research & Engineering

Speaker: Roger Sargent
Imperial College, London
"Challenges and Constraints in Computer Science and Technology"

Speaker: Stanley I. Proctor
Monsanto Company
"Challenges and Constraints in Computer Implementation and Applications"

Session II: "Progress in Data Base Development"
Chairman: Theodore L. Leininger
DuPont Company

Speaker: Peter Winter
PROSYS Technology, Ltd, Cambridge, England
"Data Base Frontier in Process Design"

Speaker: David L. Bernhardt, Jr.
Boeing Computer Services
"Data Base Technology Applied to Engineering Data"

Speaker: Wilfred Plouffe
IBM Corporation
"Relational Data Bases for Engineering Data"

Session III: "Computational Algorithms"
Chairman: Gary E. Blau
Dow Chemical

Speaker: Warren D. Seider
University of Pennsylvania
"Physical Insights to Aid in Model and Algorithm Formulation"

Session IV: "Physical Properties for Design"
Chairman: Joseph Boston
ASPENTech

Speaker: John P. O'Connell
University of Florida
"The Structure of Thermodynamics in Process Calculations"

Speaker: Edward A. Grens
University of California, Berkeley
"Efficient Use of Thermodynamic Models in Process Calculations"

Session V: "Nonsequential Modular Flowsheeting"
Chairman: Rodolphe L. Motard
Washington University

Speaker: John D. Perkins
Imperial College, London
"Equation-Oriented Flowsheeting"

Speaker: Lorenz T. Biegler
Carnegie-Mellon University
"Simultaneous Modular Simulation and Optimization"

Session VI: "Design and Scheduling of Batch Chemical Plants"
Chairman: Richard S. H. Mah
Northwestern University
Speaker: G. V. Reklaitis
Purdue University
"Intermediate Storage in Non-Continuous Processes"

Speaker: Harold N. Gabow
University of Colorado
"On the Design and Analysis of Efficient Algorithms for Deterministic Scheduling"

Session VII: "Complex Single Unit Design"
Chairmen: Babu Joseph, Washington University,
and Bruce A. Finlayson, University of Washington

Speaker: Warren E. Stewart
University of Wisconsin
"Collocation Methods in Distillation"

Speaker: H. H. Klein
JAYCOR Scientific Research & Development
"Modeling Fluidized-Bed Chemical Reactors"

Session VIII: Contributed Papers
Chairman: Cameron M. Crowe
McMaster University

"Scheduling of Multipurpose Batch Plants with Product Precedence Constraints" by
I. Suhami, EXXON, and
R. S. H. Mah, Northwestern University

"The Prediction of Properties and Its Influence in the Design and Modeling of Superfractionators" by
M. R. Hernandez, R. Gani (Speaker),
J. Romagnoli, and E. A. Brignole,
Universidad Nacional del Sur, Argentina

"Reduced Cost Solutions to Multistage, Multi-component Separations Problems by a Hybrid Fixed-Point Algorithm" by
K. R. Westman and A. Lucia (Speaker),
Clarkson College of Technology, and
S. Macchietto, Imperial College

"Solution of Systems of Complex Interlinked Distillation Columns by Differential Homotopy-Continuation Methods" by
T. L. Wayburn and J. D. Seader (Speaker),
University of Utah

"Strategies for Simultaneous Modular Flowsheeting and Optimization" by
M. A. Stadtherr (Speaker) and H.-S. Chen,
University of Illinois - Urbana

"Recent Developments in Solution Techniques for Systems of Nonlinear Equations" by
M. Shacham, Ben-Gurion University of the Negev

Session IX: "Operability in Design"
Chairman: George Stephanopoulos,
National Technical University, Athens

Speakers: Ignacio Grossmann,
Carnegie-Mellon University, and
Manfred Morari
California Institute of Technology
"A Dialogue on Resiliency, Flexibility, and Operability - Process Design Objectives for a Changing World"

FLOWTRAN LOAD MODULES FOR UNIVERSITY COMPUTERS

As part of a continuing program of support to education, Monsanto Company announced on August 19, 1982, that load modules for the FLOWTRAN simulation program will be made available on magnetic tape to departments of chemical engineering to install on their own in-house computers. Thus, departments will be able to run FLOWTRAN on their own computers at no charge other than that of their own computer center. CACHE is currently supervising the preparation of load modules for a wide variety of main-frame-type digital computers and the distribution of the modules on magnetic tape to those departments that order them. Instructional books on FLOWTRAN are already available through CACHE.

FLOWTRAN tapes are now available for the following computers:

1. **Amdahl** computers running under the MTS (Michigan Terminal System) operating system with a FORTRAN Level G or H compiler (9-track, 6250 BPI tape).
2. **UNIVAC 1100** series computers running under the EXEC 1100 (38R2/08) operating system with the FORTRAN 77-SID (10R/A) compiler (9-track, 1600 BPI tape).
3. **IBM** and IBM-Plug-Compatible mainframe computers such as the 370, 30XX, and 43XX with the VS FORTRAN compiler (Program #5748-F03) running under the VM/CMS operating system (9-track, 1600 BPI tape).
4. **IBM** and IBM-Plug-Compatible mainframe computers such as the 370, 30XX, and larger 43XX with the FORTRAN IV - extended compiler (Program #5734-F03 plus the library) running under the OS/MVS operating system (9-track, 1600 BPI tape).
5. **DEC 20XX** mainframe computer running with the FORTRAN-20, version 7 compiler (9-track, 1600 BPI tape).

   It is also anticipated that a FLOWTRAN tape for the following computer will be available by the end of 1983:

6. **DEC VAX 11-7XX** series of super minicomputers running with the VMS operating system.

Plans are also being made now to obtain, if possible, tapes for the DEC 10, CDC, and Prime machines. Each tape contains either load and/or relocatable code, test problems and solutions, and installation instructions. The FLOWTRAN program may be used for educational purposes, but not for consulting. FLOWTRAN is already installed at:

The University of Akron (Glenn Atwood)
The University of Michigan (Brice Carnahan)
The University of Pennsylvania (Warren Seider)
Rice University (Derek Dyson and Kyriacos Zygourakis)
The University of Utah (J. D. Seader)
Worcester Poly (W. L. Kranich)

If you would like to obtain a FLOWTRAN tape for your computer and have not already expressed that desire to CACHE, complete and submit the form, FLOWTRAN TAPE, at the end of this newsletter. You will be required to sign a User's Agreement that must be approved by Monsanto. The cost of the tape, payable to CACHE, is $250. However, the charge to CACHE-supporting departments listed near the end of this newsletter is only $175.

PROGRAMS FOR HAND-HELD PROGRAMMABLE CALCULATORS

The CACHE booklet entitled **"Hand-Held Programmable Calculators: A Review of Available Programs for Chemical Engineering Education,"** by Professor F. William Kroesser of West Virginia College of Graduate Studies, is still available. In this 26-page booklet, approximately 100 programs are listed under the following subjects:

THERMODYNAMICS
Thermodynamic Properties
Equations of State
Equilibria

TRANSPORT PHENOMENA

Viscosity	Conduction
Bernoulli Equation	Convection
Pipe Flow	Radiation
Open Channel and Wier Flow	Diffusivity

UNIT OPERATIONS
Distillation
Absorption
Humidification and Cooling

PROCESS DESIGN AND CONTROL
Control Valve Size
Fluidized Beds
Compressors

Given for each program listed are 1) a description, including restrictions, 2) a literature reference to the program listing, and 3) a summary of input and output data. Sources of the programs are the HP67/97 Users' Libraries, the TI58/59 Program Exchange Club and specialty booklets, and articles in Chemical Engineering, Chemical Engineering Progress, Hydrocarbon Processing, and the Oil and Gas Journal.

An order blank for Professor Kroesser's booklet is included at the end of this issue of CACHE News.

COMPUTER-BASED INSTRUCTION VIA PLATO MORE OPTIONS AT LOWER COST

by Mordechai Shacham and
Michael B. Cutlip

Some chemical engineering materials have been created for the worldwide PLATO educational computer system of the Control Data Corporation. Access to these educational materials is with a CDC PLATO terminal connected to a mainframe computer which is dedicated to the PLATO system. Previous newsletters have discussed these materials. (See CACHE News No. 15, p. 13 and No. 16, p. 7.) Direct connection to the PLATO mainframe is made at universities such as Illinois and Delaware where dedicated computers are available. However, most typical PLATO users must use telephone communications to access PLATO from CDC computers in distant locations.

This situation has recently changed because Control Data has introduced the following new options to its educational computer system:

1. Installation of PLATO in existing or new computers
2. A multi-use microcomputer to run PLATO
3. Access to PLATO via personal computers

These options open up many new possibilities to the creation of educational materials on PLATO because the expenses associated with the computer-based instruction can be reduced significantly.

Installation of PLATO in existing or new computers

Universities that have or will purchase one of the CYBER 170 Series 800 computers from CDC can have the option of running PLATO. The system can be installed in the computer with a relatively small investment, and it will execute in parallel with other applications. No longer does the entire machine need to be dedicated to PLATO. The required PLATO Terminals can be connected directly, or telephone communications can be made from other locations. The same terminals that provide computer-based instruction to students can be used to author and program new materials. An example of a new installation of PLATO to an existing computer is found at the University of Massachusetts at Amherst.

A multi-use microcomputer for PLATO

The CD 110 is actually a microcomputer system which has a minimal configuration consisting of a Control Data 721-30 Viking terminal and a flexible disk drive. The Viking terminal containing a Z80 processor has a self-contained and tiltable display, a 15-inch viewing screen, a detached keyboard, vector graphics within a 512 x 512 dot array, a 16 x 16 touchpanel with 256 locations on the screen, and a 64K RAM for loading and operating memory. The disk drive of the CD 110 has a Z80 microprocessor and 64K RAM. It uses a soft sector, 8-inch flexible disk with maximum capacity of 1.2 million characters.

The major benefit of the CD 110 is that it can execute in a stand-alone mode thereby eliminating communication costs as well as mainframe operating expenses. The CD 110 can be used for the delivery of lessons which are stored on the diskettes. Unfortunately, most of the mainframe PLATO materials require some conversion to run on the microcomputer. New materials can be programmed so that they run on both mainframe and micro PLATO, but connection of author terminals to the mainframe is required. It is also significant that CDC now offers a software package so that lessons for the CD 110 can be authored without a connection to any mainframe. This application requires two disk drives.

The CD 110 has additional flexibility in that it can operate as a microprocessor with a CP/M operating system. This application gives 55K of memory to the user. Also the CD 110 can be used to communicate with other mainframe computers by emulating both dumb and intelligent terminals. Since it can also act as a terminal to a mainframe PLATO computer, it has wide versatility for educational utilization.

At this time, materials for the micro PLATO mode have been created by Control Data with the help of several universities for basic courses which are typically found in a lower division engineering curriculum. Courses available on disks include FORTRAN 77, chemistry, and physics. A number of universities will be evaluating this mode of computer-based instruction during this upcoming academic year. Chemical engineering materials are being converted, and details will be made available in this Newsletter.

Access to PLATO vis personal computers

CDC has announced that personal computer users such as the IBM can access a PLATO Microlink which permits telephone access to selected lessons and courses (also games and electronic communications). Some of the standard PLATO features, such as the touch-sensitive screen, will not be available. A one-time charge of $50 will cover an access disk. After a registration fee of $10, the use charges are to be $5/hr.

Future Prospects for Computer-Based Instruction

There seems to be intense activity at the present time which is resulting in increased capabilities at reduced cost. An enouraging trend is developing regarding the portability of educational materials. What we see at present is just the beginning. It is hoped that this Newsletter can keep you informed of current developments. Should you like to participate in the CACHE Task Force in Computer-Based Instruction, please contact either:

Dr. Michael B. Cutlip
Dept of Chemical Engrg
Univ of Connecticut
Storrs, CT 06268
(203) 486-4019

Dr. Stanley I. Sandler
Dept of Chemical Engrg
Univ of Delaware
Newark, DE 19711
(302) 738-2945

MEETINGS AND CONFERENCES

October 30 - November 4, 1983
AIChE Diamond Jubilee Meeting, Washington, DC
Sessions on:
Innovations in Applied Math
Computer-Aided Process Analysis and Synthesis
Computer-Aided Engineering
Directions in Process Control
Computers and the Control of Biological Processes
Evaluated Thermo Properties for Process Design

December 6-8, 1983
Software Maintenance Workshop, Monterey, California
Sponsored by IEEE et al.; Contact Professor Norman Schneidewind, Chairman, Code 54Ss, Naval Postgraduate School, Monterey, CA 93940
(408) 646-2719 or 646-3211

December 12-14, 1983
Winter Simulation Conference, Arlington, Virginia
Sponsored by SCS et al.: Contact Bruce Schmeiser, School of Industrial Engineering, Purdue University, West Lafayette, IN 49707
(317) 494-5422

February 2-4, 1984
SCS Multiconference: Modeling and Simulation on Microcomputers, Simulation in Health Care Delivery Systems, Simulation in Strongly Typed Languages - ADA, PASCAL, SIMULA, Aerospace Simulation
Sponsored by SCS; Contact Charles A. Pratt, SCS, P.O. Box 2228, LaJolla, CA 92038
(619) 459-3888

February 26 - March 3, 1984
First International Symposium on Modeling and Control in Mineral Processing and Process Metallurgy, Los Angeles, CA
Co-sponsored by SME/TMS of AIME; Contact J. A. Herbst, Dept of Metallurgy, University of Utah, 412 Browning Bldg, Salt Lake City, UT 84112
(801) 581-6386

May 20-24, 1984
AIChE Annual Meeting, Anaheim, CA
Sessions on:
Process Modeling with Computers
Process Data Reconciliation and Rectification
Human Factors in Computer Control
Software for Advanced Computer Control
Software for Control System Design
Process Towards Process Engineering Workstations
Microcomputers (5 sessions)

June 12-14, 1984
SIAM Conference on Numerical Optimization, Boulder, CO
Sponsored by SIAM; Contact H. B. Hair, SIAM, Suite 1405, 117 South 17th Street, Philadelphia, PA 19103
(214) 564-2929

June 19-21, 1984
Fifth IMACS International Conference on Computer Methods for Partial Differential Equations, Bethlehem, PA; Contact William E. Schiesser, Dept of Chemical Engrg, Whitaker Lab #5, Lehigh University, Bethlehem, PA 18015
(215) 861-4264
Sessions on:
Methods, Applications, Programming, and Hardware

June 20-22, 1984
First International Conference on Computers and Applications, Beijing (Peking), China
Sponsor CIE, IEEE Computer Socs; Contact H. Hayman, IEEE Computer Soc., 1109 Spring St., Suite 300, Silver Spring, MD 20901
(301) 589-8142

July 8-14, 1984
Gatlinburg IX, Householder-Gatlinburg Meeting on Numerical Algebra, Waterloo, Ontario, Canada
Contact J. A. George, Computer Science Dept, University of Waterloo, Waterloo, Ontario N2L 3G1 Canada
(519) 885-1211, ext 3473

July 24-27, 1984
International Congress on Computational and Applied Mathematics, Lueven, Belgium
Contact Professor F. Broeckx, University of Antwerp, (RUCA), Faculteit Toegepaste, Economische Wetenschappen, Middelheimlaan 1, B-202, Antwerpen, Belgium
Sessions on:
Analysis of computational techniques for solving real scientific problems

September 2-6, 1984
IFIP Conference on System Modeling and Optimization, Budapest, Hungary
Contact IFIP Secretariat, 3 rue du Marche, CH-1204 Geneva, Switzerland

March 31 - April 13, 1985
Institution of Chemical Engineers, Rugby, England
Conference on Use of Computers in Chemical Engineering; Contact F. A. Perris, Air Products, Ltd., Hershen Place, Molesey Road, Walton-on-Thames, Surrey KT 12 4RZ, England

July 29 - August 2, 1985
World Conference on Computers in Education, Norfolk, VA
Sponsors: IDIP/TC-3 and AFIPS; Contact John McGregor, Computer Science Dept, Christopher Newport College, Newport News, VA 23606

STATUS OF CHEMI PROJECT

by
David M. Himmelblau

Advances in computer science and telecommunication systems technology throughout the 1970's have contributed to the development of new techniques and systems for the education of scientists and engineers. The CHEMI project represents such an effort in the field of chemical engineering.

The first phase of the project, begun in 1975 via a grant from the National Science Foundation, resulted in the production of more than 300 single-topic, stand-alone instructional modules spanning the key subject areas in the undergraduate chemical engineering curriculum. Each module is approximately 20 pages and covers a subject content roughly equivalent to one contact hour of lecture. These modules were originally written for off-line study and are being published by the AIChE as the Modular Instruction Series.

The second phase of the CHEMI project has developed an on-line information system that will access over 500 abstracts of key topics taken from chemical engineering encyclopedias, handbooks, and journals, plus (eventually) 400 instructional modules covering the following subjects: Material and Energy Balances, Thermodynamics, Transport Phenomena, Stagewise and Mass Transfer Processes, Process Control, Kinetics, and Design. The CHEMI system has been designed to serve as a model for other disciplines that might benefit from an on-line, modularized data base.

One of the major goals of Phase II of the CHEMI project was to develop a computer-aided instruction package that would contain, in addition to the information system, modules designed to be used in interactive learning and testing. Because of the limitations of time and funds, the number of modules that have been entered into the data base of the system has been limited to approximately 100; and the interactive testing feature of the system has been omitted. The unexpected high cost of designing and coding the required software for the CHEMI information system prevented designing an interactive computer-aided instruction program as elaborate as, for example, the PLATO system. The

CHEMI on-line system focuses on information retrieval, primarily for searching, diagnostics, and reference. The system allows on-line access to the modules and abstracts through a keyword search of the index and sequence selection. A module, part of a module, or any screen of information can be printed off-line. The shortest path through a sequence of modules for a curriculum can also be obtained.

Figure 1 is an example screen from the on-line information system that shows the basic functions of the system:

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-------------------------------------------------------------------
ANYTIME:       | The main functions of the CHEMI system are:
a. Help        | a.Help......Help in deciding which choice to enter
b. Keyword     | b.Keyword...Keyword search of the CHEMI index
c. Mod/Ab      | c.Mod/Ab....Select a module or abstract by number
d. Paths       | d.Paths.....Select a sequence of modules to study
e. Print       | e.Print.....Select a print option
f. Logout      | f.Logout....Logout
g. Menu        | g.Menu......Display this page
---------------|
               | ANYTIME choices can be entered at any stage in
               |         your session with CHEMI.
               |
               | ADDITIONAL choices can be entered whenever you see
               |         them listed in the lower left-hand box on
               |         the screen.
               |
               | To start, enter a letter to indicate your choice.
               |
               |---------------------------------------------------
               | Your choice:
-------------------------------------------------------------------
```

Figure 1. A Screen from the information system showing the main functions of the system

The information system has been written in the "C" programming language and runs on the UNIX operating system, version 7, on a DEC PDP-11/23 minicomputer. The choice of C as the language makes the source code highly portable between computers because C is a young language whose conventions have been standardized. The language is highly structured, which is desirable for good programming, and it is modular. The machine and operating-system routines are isolated, allowing a program to be easily expanded. As UNIX becomes more widely accepted as an operating system, the C language is gaining in popularity, especially on microcomputers.

In designing and implementing the on-line CHEMI system, we have gained a thorough understanding of the problems that can evolve through lack of prior knowledge of computer systems and programming costs. The hardware that was purchased for the project includes a PDP 11/23 minicomputer with 256 kilobytes of random-access memory (see Figure 2). Although there were relatively few problems with the computer, we did make the mistake of setting up a service contract for the computer with a company located nearly 80 miles from our site in Austin. As we did not have a tape drive on our hardware system, this meant that when we needed to transfer files from PDP 11 disks to tape, much time was lost in arranging for service.

In the planning stage of the project, it was thought that there would be two versions of the CHEMI system made available:

Version 1 (for output on dumb terminals and line printers) would have the following characteristics:

- allow retrieval on standard ASCII terminals
- ASCII characters only
- spelled-out Greek letters, functions, and operations (Figure 3)
- simple figures only (Figures 4 and 5)
- would require an accessory package of printed material containing complex figures, study questions and answers, and computer programs

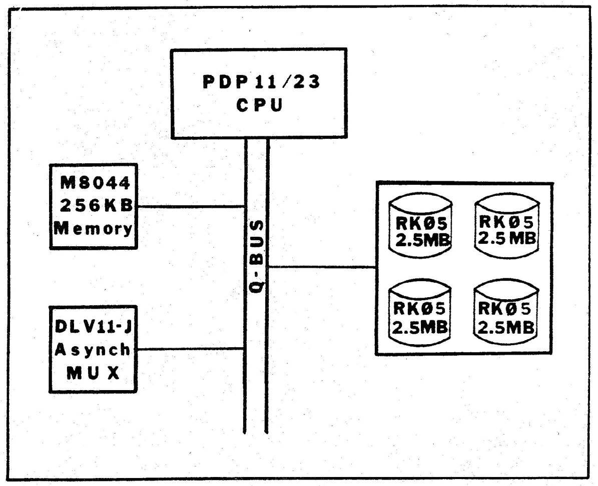


Figure 2. UNIX PDP 11/23 Minicomputer Configuration

For a single stream, if we leave out the change in internal energy and divide both sides of Eq.(3) by the mass, m, being conveyed, we obtain the well known Bernoulli equation:

$$\Delta \left(\frac{P}{\rho}\right) + g \Delta Z + \frac{1}{2} \Delta u^2 = 0 \qquad (4)$$

where ρ is the density and $\Delta Z = Z_{exit} - Z_{entrance}$ etc. Eq. (4) is frequently referred to as a mechanical energy balance.

Figure 3a. Example of an Equation - Original Format

```
For a single stress, if we leave out the change in  internal
energy and divide both sides of equation (3) by the mass, m,
being conveyed, we obtain the well known Bernoulli equation:

         P                                        2
DELTA (---) + (g)[ DELTA (Z) ] + 1/2 DELTA (u )  =  0    (4)
        RHO

where RHO is the density and DELTA(Z) = ( Z     - Z )    etc.
                                           exit    entrance

Eq. (4) is frequently referred to  as  a  mechanical  energy
balance.
```

Figure 3b. Example of an Equation - On-Line Format

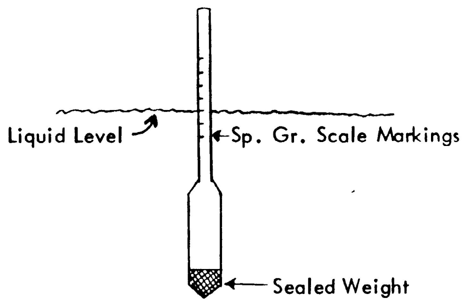


Figure 1. A Typical Hydrometer.

a. Original Drawing

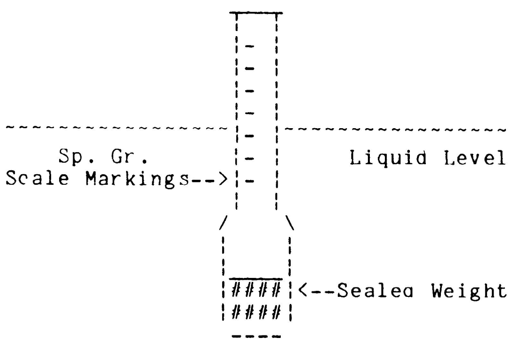
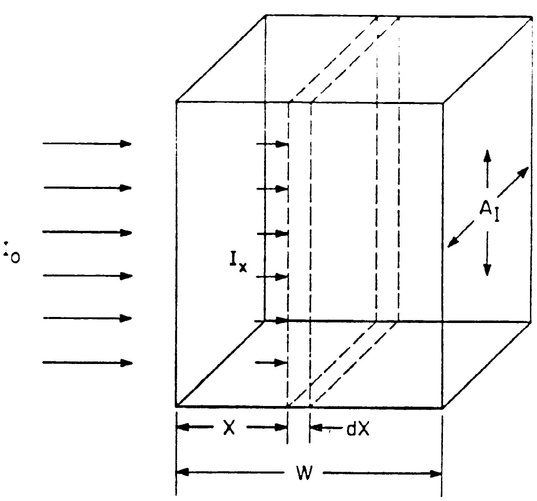


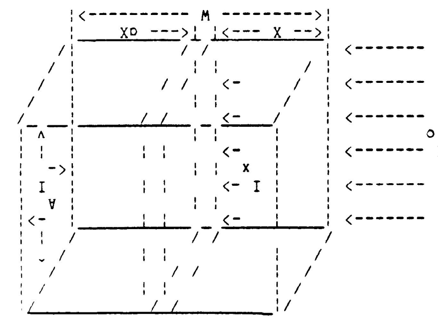
Figure 1. A Typical Hydrometer

b. On-Line Drawing

Figure 4. Example of a Two-Dimensional Drawing



a. Original Drawing (Module KIN 30)



b. On-Line Drawing (Module KIN 30)

Figure 5. Example of a Three-Dimensional Drawing

Version 2 (for output on graphics terminals and printers) would have the following characteristics:

- would permit the use of alternate character sets for math symbols and Greek letters
- would include all the figures possible to reproduce in a graphics mode.

In creating the data base for Version 1, because of certain limitations in the capabilities of standard ASCII terminals, we had to develop extensive guidelines for equation formatting that set standards for Greek letters, subscripts and superscripts, and certain mathematical symbols. Chemical engineering students were polled at the University of Texas at Austin, asking them to rank various equation formats as to preference. The results of the polls set the standards for the equation formatting used in CHEMI modules. Transposition of the original equations into the prescribed format has taken more time than expected because the modules must be carefully proofed to avoid error. Because the data entry has taken longer than planned, the final testing and debugging of the program cannot be undertaken until the module data base is complete. Table 1 summarizes the average costs experienced in preparing the various components of a module.

Table 1. Average Costs per CHEMI Module

Module Item	Cost
Solicitation & Review	$ 2.60
Authoring	91.67
Editing	34.95
Indexing	16.08
Data Entry	
Text	29.50
Equations	34.41
Figures	8.37
Formatting	19.40
	$236.98

The costs listed in this table do not include computer services of approximately 9 minutes per module for TM charges (CPU time and input/output charges) on the DECSYSTEM-20 and approximately 8 hours per module for real-time charges on the NGP-PDP 11/70. The DEC 20 charges $200/hr TM time, and the NGP charges $3/hr real time.

We have not produced Version 2 of the CHEMI system although we have employed the DEC GIGI system's graphics editor to enter some figures in the Materials and Energy Balance modules (see Figures 6 and 7). We have found it costly to enter data using the graphics editor, and the software for some functions that we need is not yet available.

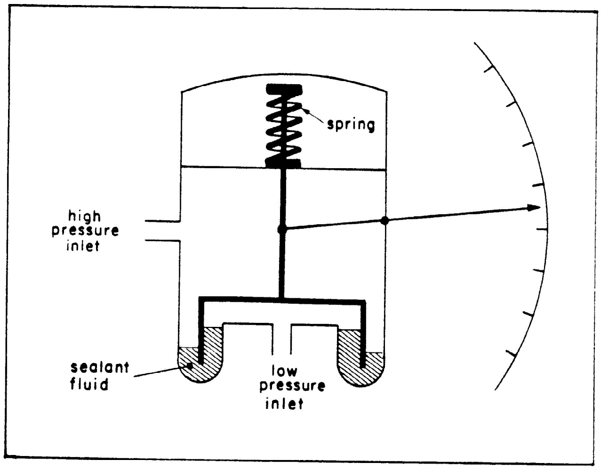


Figure 6a. Original Drawing (Module MEB 5)

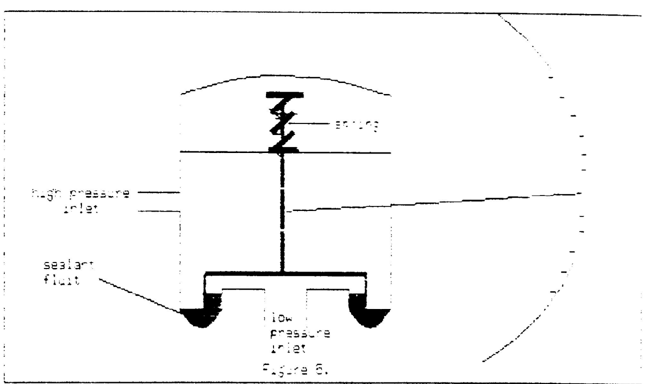


Figure 6b. GIGI On-Line Drawing (Module MEB 5)

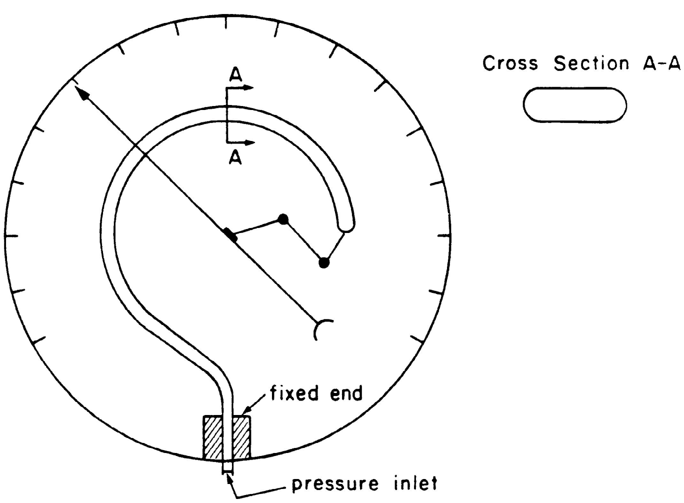


Figure 7a. Original Drawing (Module MEB 5)

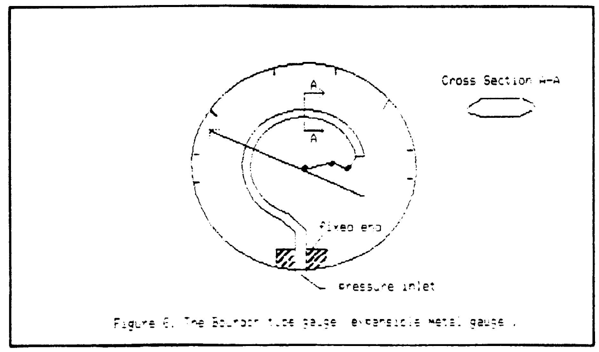


Figure 7b. GIGI On-Line Drawing (Module MEB 5)

During the preliminary planning of the project, in the late 1970's, the decision was made to design the CHEMI system so as to avoid hardware dependency in order that it would be highly portable. It was thought that the microcomputers and terminals would not be standardized among the many colleges and universities using computer-based educational materials thus preventing the widespread use of any information system that was dependent on hardware. Furthermore, hardware rapidly becomes obsolete. There was agreement that there would be a number of standard ASCII terminals available to college and university students for a good many years to come and that their cost would remain relatively low.

Since the start of the CHEMI project, developments in electronics and computer science have refined the capabilities of graphics programs, and at the same time the costs of equipment have been reduced. The cost of graphics terminals and printers may reach a level compatible with most school budgets. Nevertheless, there is still no standardization in graphics protocols; hence no portability. If this issue is ever resolved, the CHEMI system's data base of modules can be altered to accommodate the specifications. The system's flexibility allows it to adapt easily in response to rapid technological change.

Trends in today's society toward decentralization are evidenced by the increased use of microcomputers. The development of decentralized systems and services brings the capabilities of on-line processing well within the budget range of colleges and universities, as well as individuals. The electronic dissemination of educational materials developed by the CHEMI project will make available, to students and practicing engineers, information on-line that is necessary for them to keep pace with the major trends that are shaping our society.

STATUS OF MICROCACHE PROJECT

by Brice Carnahan

The final report on the MicroCACHE Project was submitted by Professors Brice Carnahan and H. Scott Fogler to the NSF in April, 1983. The report is in one main document plus five system documents:
1) User's Manual; 2) Module Preparation Guide; 3) Overview of System Architecture; 4) Graphics Package; and 5) Instructor's Manual. Altogether, 12 modules were prepared, with five being tested by students at the University of Michigan. A new version of the supervisory system has been implemented, and all 12 modules are now being converted over to this new system. This will be followed by student testing at several different schools.

For the NSF-funded project, an Apple-II Plus microcomputer equipped as follows was chosen as the development machine for the MicroCACHE system software:

48K Apple-II Plus
16K RAM extension board
2 Disk drives
1 Microsoft Z-80 softcard
1 Monochrome monitor

The principal reasons for choosing the Apple were its record for reliability, widespread availability, and the substantial amount of existing hardware and software available for it. It was clear from the beginning that 64K main memory might be restrictive from the standpoint of software organization and that the processing speed might be slower than desirable for computationally intensive engineering problems; however, at the time, 64K was the largest available memory in any of the popular microcomputers; and the Z-80 processor speed was comparable to that for processors used in the other most widely used microcomputers. Currently, the system is being converted to the IBM/PC.

The purposes of this project, under the direction of Professors Brice Carnahan and H. Scott Fogler, were to:

1. Develop prototype micrcomputer-based software for delivering educational materials and programs (modules) for chemical engineers and engineering students, and
2. Prepare several educational modules to test the software.

Mr. Mark Maletz functioned as the principal project systems analyst and programmer, and many graduate and undergraduate students at the University of Michigan were involved.

Most of the goals of the first phase were met. The highly modular and reasonably transportable MicroCACHE supervisory system was designed, written, debugged, and tested using the Apple-II microcomputer as the development hardware. Several major system utility programs that allow module authors to prepare educational modules and incorporate them into the MicroCACHe framework were written, thoroughly debugged, and tested. Prototype educational modules were written and debugged. Some were tested with students at the University of Michigan and seemed to be well received by them. Testing continues at Michigan and will be extended to other Chemical Engineering departments in the near future.

More information can be obtained by writing to

Professor Brice Carnahan
Dept of Chemical Engineering
University of Michigan
Dow Bldg, North Campus
Ann Arbor, MI 48109

FORTRAN TEACHING CODE NEEDED

WANTED: A FORTRAN code that teaches FORTRAN using the computer only. If you have such a code that you can share with another university, write

Professor David M. Himmelblau
Dept of Chemical Engineering
University of Texas
Austin, TX 78712

SYSOPT
OPTIMIZATION SOFTWARE FOR APPLE II

SYSOPT is a software package for the solution and/or demonstration of (mainly) unconstrained optimization programs on an Apple-II plus microcomputer. One routine for constrained optimization is included. SYSOPT is built up from different, separate modules. Following the selection made by the user, the necessary routines are loaded from floppy disk into the memory of the micro.

The library offers the following optimization algorithms:

*unconstrained optimization:
- a. one-dimensional search
  - Fibonacci
  - Davies, Swann & Campey
  - Fletcher (inexact line search)
- b. n-dimensional optimization
  - Rosenbrock & Palmer
  - Powell
  - Fletcher & Reeves
  - Davidon, Fletcher & Powell (DFP)
  - Complementary DFP-algorithm (BFGS)

*constrained optimization
- Penalty functions

General Information on SYSOPT

* The program is interactive and completely menu driven.

* The problem formulation consists of the definition of the objective function and of the equality and inequality constraints. Eventually the gradients of the objective function should also be stated. The objective function f(X) can be given by an analytical expression or by a

recursive relation. The function values may also be the results of a computer program. It is also possible to introduce the function values directly.

* SYSOPT will propose a standard procedure which can be accepted or rejected. If the proposed procedure is rejected, the user will be able to put together another procedure selected through a series of menus. When all selections are made, the user can have the chosen procedure registered as the future standard.

* For an algorithm, based on derivative values, one can choose to use either numerically or analytically derived gradients.

* For each algorithm default, options are provided for the stopping criterion. These options can eventually be changed by the user. The same is true for all heuristic parameters that need to be introduced.

* For Fletcher-Reeves, DFP, and BFGS, the possibility exists of restarting the algorithm after each n+1 iteration.

Constrained Optimization

* The only technique made available here is the penalty function technique. It reduces the constrained problem to an unconstrained one. For inequality constraints, the interior approach is used and for equality constraints, the exterior approach.

* If the starting point, provided by the user, is not feasible for the inequality constraints, then the code will generate a feasible point through a Phase-I procedure.

* The user can influence the sequence of unconstrained problems to be solved by selecting the penalty coefficient and the reduction factor for this coefficient in subsequent problems.

Manual

A typewritten manual is provided, together with a manual written as a file for the APPLE Writer and residing on the same disk as the SYSOPT program.

The code is available at a price of $150.

Please contact:

Professor M. Rijckaert
Instituut voor Chemi-ingenieurstechniek
de Croylaan 2
B-3030 Heverlee
Leuven, Belgium

NEW NUMERICAL METHODS SOFTWARE

by Bill Schiesser

The following new items of software may be of interest to those involved in the application of numerical methods:

1. **ODEPACK** (Alan C. Hindmarsh) - Systematized collection of ODE solvers for application of initial-value ODE solvers to PDE's via the numerical method of lines. Contact:

   National Energy Software Center
   Argonne National Laboratory
   9700 Cass Avenue
   Argonne, IL 60439

2. **PITCON** (Werner C. Rheinboldt and John V. Burkardt) - Package of procedures for solving sets of nonlinear equations by differential homotopy continuation, Algorithm 596. Contact:

   Algorithms Distribution Service
   ISML Libraries, 6th Floor NBC Bldg
   7500 Bellaire Blvd
   Houston, TX 77036

3. **DSS/2**, version 2, release 3 (William E. Schiesser) - Library of transportable subroutines of initial-value ODEs and PDEs. This new release has features that include:

   -A variable-grid spatial differentiation routine for one-dimensional PDEs based on five-point Lagrange interpolation polynomials. The approximation of the spatial derivatives can be centered for parabolic PDEs and noncentered (five-point biased upwind) for hyperbolic (convective) PDEs, with the grid points located by the user to accommodate rapidly changing solutions in space.

   -Two variable-grid spatial differentiation routines for one-dimensional PDEs based on cubic splines with numerically approximated third derivatives as end conditions. The grid points can be located by the user to accommodate rapidly changing solutions in space. The usual requirements of finite element and weighted residual approximations do not apply to these routines, e.g., compatibility of initial and boundary conditions, boundary conditions of a prescribed form requiring the temporal derivatives of the boundary condition functions, inextricable linkage of the spatial and temporal integrations.

   - Two routines based on five-point Lagrange interpolation polynomials for two- and three-dimensional PDEs. The user may select centered and noncentered approximations in each of the spatial directions so that these routines, in combination with the earlier one-dimensional routines, can accommodate convective-diffusion (hyperbolic-parabolic) PDEs in one-, two-, and three-dimensional routines can, in principle, be used in any orthogonal coordinate system, e.g., Cartesian, cylindrical, spherical coordinates.

   - Two utilities for mapping the Jacobian matrix of an ODE system and computing its temporal eigenvalues. Since PDEs are integrated in DSS/2 by the numerical method of lines, the approximating ODEs can also be analyzed by these routines. The map of the ODE Jacobian matrix gives a direct indication of the problem structure which is invaluable in the selection of the temporal integrator. The temporal eigenvalues directly indicate whether the ODE system is: 1) computationally stable, 2) sufficiently stiff to require an implicit integrator, and 3) correctly programmed with respect to the problem time scale.

The DSS/2 FORTRAN IV source code on 9-track tape is available to academic institutions for $250 and to industry for $1000. Contact:

Dr. William E. Schiesser
Dept of Chemical Engineering
Lehigh University
Whitaker Lab No. 5
Bethlehem, PA 18015

PERSONAL COMPUTER USERS SURVEY

by
Bruce Finlayson

The last issue of CACHE News included a form to determine the extent to which microcomputers were being used at universities and interests of those responding. A total of 54 responses gave the following results:

Microcomputer	No. of Schools
Apple	28
IBM	13
Commodore	8
HP	5
Radio Shack	5

Interests	No. of Institutions
Design & Simulation	26
Control	20
Computer-Aided Instruction	19
Data Acquisition	18
Physical Properties	13
UG Education	10
Distillation	7
Numerical Utilities	4

Each school responding has received a list of universities having the same type of microcomputer and a list of persons having the same interest. The program dBaseII was used to produce the lists.

CACHE MICROCOMPUTER TASK FORCE SURVEY

on
MICROCOMPUTERS AND PERSONAL COMPUTERS IN AMERICAN AND CANADIAN DEPARTMENTS OF CHEMICAL ENGINEERING

by
Peter R. Rony and Joe D. Wright

Late in November, 1982, the newly formed CACHE Microcomputer Task Force sent a CACHE Questionnaire to about 150 departments of chemical engineering in the United States and Canada. The reason for distributing the questionnaire was stated as follows:

> "The CACHE Real-Time Task Force has been replaced by the CACHE Microcomputer Task Force, which better reflects the real-time computing activities that are currently going on in chemical engineering departments in the United States, Canada, and Mexico. Since this is a new task force, it is appropriate to develop a questionnaire that probes current work, by chemical engineering faculty, with microcomputers or personal computers in laboratory applications such as real-time control, data logging, system timing, etc.; the availability of information on such work, including reports, articles, and theses; what can be done to improve the perception of university administrators of the value of such work; suggested activities for the CACHE Microcomputer Task Force; and local interest in "CACHE consultants."

Most of the 46 responses to the questionnaire were received during the period January through April, 1983, with a few being received before and after this period.

A 46-page report is being sent to all CACHE member institutions as well as to those individuals who participated in the survey.

In view of the recent excitement that has been created among colleges of engineering as a direct consequence of the pioneering decisions by Clarkson University and Drexel University to require all of their entering freshmen in 1983 to purchase specified models of personal computers (a Zenith Z100 at Clarkson and a special Apple computer at Drexel), some of the results of the survey--notably the responses in Items 16 and 17--are probably already obsolete.

The survey should therefore be viewed as a snapshot in time; namely, perceptions during the 1982-83 academic year. The authors believe that in a few years we shall look back on these results and conclude that they reflected the "calm before the storm," the storm being an avalanche of personal computers being placed in the hands of engineering undergraduate students, graduate students, and faculty; and the calm being a conservative view of the future by chemical engineering educators.

The central focus of the report is Appendix B, which provides verbatim the 46 responses to the 17 items in the questionnaire. Some of the individual comments are quite interesting. Rather than summarize the results of the survey, the brief commentary contained in the report provides conclusions and recommendations for action by the CACHE Corporation and the CACHE Microcomputer Task Force. Specific topics in the commentary include:

The Microcomputer Smorgasbord
Information Dissemination is an Important Opportunity for CACHE
Procedure for Submitting Microcomputer Information Items to CACHE News
Chemical Engineering Faculty Tend to Prefer Packaged Laboratory Systems
The "CACHE Consultants" Idea Should Be Tested
Sample "CACHE Consultant" Resume
The CACHE Microcomputer Task Force

We would like to thank those faculty members who graciously provided their time to answer our questionnaire in detail. Your names will be added to the mailing list of the CACHE Microcomputer Task Force.

CACHE MICROCOMPUTER TASK FORCE - UNIVERSITY CONTACTS

The CACHE Microcomputer Task Force is developing a mailing list of faculty members who are interested in microcomputers and wish to receive announcements of task force activities. Faculty representatives who have been added as University Contacts since the September 1982 issue of CACHE NEWS are listed below. If your department is not represented and you would like to serve as our contact, please send your name and phone number on your department letterhead to

Dr. Peter Rony
Dept of Chemical Engineering
Virginia Polytech Institute & State Univ
Blacksburg, VA 24061

Richard G. Akins, Kansas State Univ
Paul R. Amyotte, Technical Univ of Nova Scotia
Donald K. Anderson, Michigan State Univ
Yaman Arkun, Rensselaer Polytech Institute
Glenn A. Atwood, Univ of Akron
Philip M. Becker, Christian Brothers College
Robert F. Benenati, Polytech Inst of New York
Ali Cinar, Illinois Inst of Technology
A. Constantinides, Rutgers Univ
Armando Corripio, Louisiana State Univ
Cameron M. Crowe, McMaster Univ
Sebastiao F. de Azevedo, Univ do Porto
Ray Desrosiers, Texas Tech Univ
Prasad Dhurjati, Univ of Delaware
Philip F. Dickson, Colroado School of Mines
Peter Douglas, Queen's Univ
Thomas F. Edgar, Univ of Texas
Robert V. Edwards, Case Western Reserve Univ
M. N. Esmail, Univ of Saskatchewan
Jack Famularo, Manhattan College
L. T. Fan, Kansas State Univ
Clifford E. George, Mississippi State Univ
Richard E. Gilbert, Univ of Nebraska
Thomas M. Godbold, Vanderbilt Univ
Rakesh Govind, Univ of Cincinnati
David J. Graves, Univ of Pennsylvania
Bret L. Halpern, Yale Univ
Deran Hanesian, New Jersey Inst of Tech
Michael E. Hanyak, Jr., Bucknell Univ
John Heydweiller, Syracuse Univ
Gerald D. Holder, Univ of Pittsburgh
Alan P. Jackman, Univ of California, Davis
Carl P. Jeffreson, Univ of Nevada, Reno
Babu Joseph, Washington Univ
Deniz Karman, Univ of New Brunswick
Joseph L. Katz, Johns Hopkins Univ
Kent S. Knaebel, Ohio State Univ
R. Krishnan, Pratt Institute
C. William Lee, Univ of Dayton
Young H. Lee, Drexel Univ
Ludwig Luft, Tufts Univ
Roberto Melo, Univ de Concepcion
Stephen S. Melsheimer, Clemson Univ
J.-Claude Methot, Laval Univ
H. E. Nuttall, Univ of New Mexico
James O. Osburn, Univ of Iowa
Jean Paris, Ecole Polytech, Quebec
Michel Perrier, Ecole Polytech, Quebec
Leonard K. Peters, Univ of Kentucky
Jonathan Phillips, Pennsylvania State Univ
George W. Preckshot, Univ of Missouri-Columbia
N. L. Ricker, Univ of Washington
F. Joseph Schork, Georgia Inst of Technology
J. D. Seader, Univ of Utah
Oliver C. Sitton, Univ of Missouri - Rolla
Tadeusz K. Slawecki, Youngstown Univ
Philip Smith, Brigham Young Univ
Luh C. Tao, Univ of Nebraska-Lincoln
Charles M. Thatcher, Univ of Arkansas
John Tierney, Univ of Pittsburgh
Van Wormer, K. A., Jr., Tufts Univ
John W. Walkinshaw, Univ of Lowell
Ralph White, Texas A & M

FOURTH - AND FINAL - CACHE SHORT COURSE ON MICROCOMPUTER INTERFACING/PROGRAMMING

Should there be sufficient interest, the fourth, and final, CACHE short course on microcomputer interfacing/programming will be hosted by the Dept of Chemical Engineering, Virginia Polytechnic Institute & State University during the winter quarter, 1984. Possible dates for the course are either January 9-13, January 16-20, January 30-February 3, February 6-10, or February 13-17. Several faculty members are planning to attend the short course, but we do not have a sufficient number yet to make firm plans to offer the course. If you are interested--and this is your last chance--send a letter and all dates that are acceptable to

Dr. Peter R. Rony
Dept of Chemical Engineering
Virginia Polytechnic Institute & State Univ
Blacksburg, VA 24061

Short course fees--which we estimate to be no more than $65, a figure that includes all course texts--will be very low since participants do not have to share the travel and lodging costs of the lecturer. Additional laboratory and text material currently being written for the FOX trainer--and available in January or February 1984--will cover a range of topics from digital electronics to microcomputer programming/interfacing in a novel way that emphasizes the similarities and tradeoffs between hardware and software. No prior experience in digital electronics or microcomputers is required.

See the April 1983 CACHE NEWS for additional information on the CACHE short courses.

LIST OF INDUSTRIAL CONTRIBUTORS TO CACHE

The following companies have contributed financial support to specific CACHE activities during 1981-83:

Chiyoda Chemical Engineering and Construction Company
Digital Equipment Company (DEC)
DuPont Committee on Educational Aid
EXXON Research & Engineering Company
The Halcon SD Group, Inc.
Monsanto Fund, Monsanto Company
Olin Chemicals Corporation
Process Simulation Intl
Shell Companies Foundation
Tennessee Eastman Co.
Weyerhaeuser Company

LIST OF CHEMICAL ENGINEERING DEPARTMENTS SUPPORTING CACHE

CACHE recently concluded a solicitation of universities for funds to carry out on-going CACHE activities and to provide seed money for new projects. Departments providing support for the 1982-84 period, as well as the 1981-83 period, are as follows:

1982-1984

University of Arizona
Auburn University
University of California, Berkeley
University of California, Davis
University of California, Santa Barbara
Clemson University
Colorado School of Mines
University of Colorado
University of Connecticut
Cornell University
Georgia Institute of Technology
University of Houston
Howard University
Illinois Institute of Technology
Iowa State University
University of Iowa
Johns Hopkins University
Kansas State University
University of Kentucky
Lafayette College
Lehigh University
Louisiana State University
University of Maryland
University of Michigan
Michigan Technological University
University of Minnesota
Mississippi State Univ
University of Nevada, Reno
New Jersey Institute of Technology
City College of New York
University of North Dakota
Northeastern University
Northwestern University
Ohio State University
University of Pittsburgh
Princeton University
Purdue University
Rensselaer Polytech Institute
Rose-Hulman Institute of Technology
University of Sidney
South Dakota School of Mines
University of South Florida
University of Southwestern Louisiana
Virginia Polytechnic Institute and State University
Washington University
West Virginia College of Graduate Studies
West Virginia Institute of Technology
West Virginia University
Widener University
University of Wyoming
University of Waterloo

1981-1983

University of Alabama
Brigham Young University
Bucknell University
California State Poly Univ, Pomona
University of California, Davis
University of California, Santa Barbara
California Institute of Technology
Carnegie-Mellon University
Case Western Reserve University
University of Cincinnati
Clarkson College of Technology
Cleveland State University
University of Dayton
University of Delaware
University of Florida
Kansas State University
Lamar University
Michigan State University
University of Nebraska
Polytech Institute of New York (Brooklyn)
Ohio University
University of Oklahoma
Oklahoma State University
Oregon State University
University of Pennsylvania
Pennsylvania State University
University of Rhode Island
University of Rochester
Stevens Institute of Technology
University of Tennessee
University of Texas
Texas A & M University
Texas Tech University
University of Toledo
University of Tulsa
University of Utah
University of Virginia
University of Washington
Wayne State University
University of Wisconsin, Madison
Worcester Polytechnic Institute
Yale University
Youngstown State University
University of Alberta
University of Calgary
University of New Brunswick
Nova Scotia Technical College
Universidad de las Americas
Universidad de Concepcion
Eidgenossische Technische Hochschule (E.T.H.)
Universidad Nacional del Sur

CACHE TASK FORCES

Most of the work done by CACHE is through the efforts of its task forces. Current task forces and chairmen are as follows. Please note the newly formed task force on process design case studies. Those wishing to work on task forces are encouraged to contact the designated chairman.

Task Force

CACHE Conferences:
Professor Richard S. H. Mah
Northwestern University

Data Management:
Professor R. L. Motard
Washington University

CHEMI Continuation:
Professor D. M. Himmelblau
University of Texas, Austin

Graphics:
Professor G. V. Reklaitis
Purdue University

Large-Scale Systems:
Professor J. D. Seader
University of Utah

Personal Computing:
Professor H. S. Fogler
University of Michigan

Microcomputers:
Professor P. R. Rony
Virginia Polytechnic Institute and State University

Process Design Case Studies:
Professor M. Morari
California Institute of Technology

Computer-Based Instruction:
Professor M. Cutlip
University of Connecticut

CACHE COMPUTER PROGRAMS FOR CHEMICAL ENGINEERING STILL AVAILABLE

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6b. Digital Computer Architecture (Engelberg and Howard)

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15. System Justification, Selection, and Installation (Smith)
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A. Process Analysis and Description (Edgar)

B. Digital Computer Control and Signal Processing Algorithms (Edgar and Wright)

These monographs are intended for use in lab courses, in self-study, and by real-time users at all levels because they contain many detailed examples. The monographs have been in heavy demand, particularly due to the trend towards use of real-time computing in the undergraduate laboratory. The monographs are being used as texts in a numer of universities and are available as single volumes at $3.75. Complete sets are now being closed out at $15.00, plus postage and handling from

Professor Brice Carnahan
CACHE Publications Committee
Chemical Engineering Department
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