CACHE NEWS

News About Computers In Chemical Engineering Education.

No. 13

September, 1981

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 projects 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 the CACHE Newsletters. Individual inquiries should be addressed to

CACHE Corporation
3062 MEB
Salt Lake City, Utah 84112
(801) 581-6916

CACHE NEWS

The CACHE News is published one or 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. This issue was edited by J. D. Seader with assistance from Thomas F. Edgar and David M. Himmelblau.

CACHE REPRESENTATIVES LUNCHEON TO BE HELD IN NEW ORLEANS

The annual CACHE Representatives' luncheon will be held during the 74th Annual Meeting of the AIChE in Ballroom A at the Hyatt Regency Hotel in New Orleans on Wednesday, November 11, 1981, from Noon to 1:30 p.m. Among the topics to be discussed will be computer graphics and personal computing. All CACHE Representatives or their designated alternates are cordially invited to attend. Please complete and mail the form at the end of this newletter to reserve a seat at the luncheon.

CALL FOR NOMINATIONS FOR CACHE TRUSTEES

An election of new Trustees to the CACHE Corporation will be held at the Corporation's annual meeting on November 12-14, 1981. Nominations are welcomed and should be sent by October 25, 1981, to:

Professor David M. Himmelblau
Department of Chemical Engineering
The University of Texas at Austin
Austin, Texas 78712

The nominating letter for the individual should be accompanied by four copies of a biographical summary that includes:

1. Name
2. Rank
3. Department, School, Address, Phone Number
4. Education and degrees
5. Teaching experience
6. Consulting experience
7. List of books, publications, and reports
8. Research and professional interests
9. Current and previous CACHE or CACHE-related activities
10. Professional society activities.

CACHE SHORT COURSE ON MICROCOMPUTER INTERFACING/PROGRAMMING

At its spring 1981 meeting, the CACHE Board of Trustees decided to offer a short course on digital electronics and microcomputer interfacing/programming at each of three or four geographic locations during the next two years. This course would be for chemical engineering faculty who wish to develop some skills in this area and would be provided to faculty at the lowest possible cost, which was estimated to be in the range of $50 to $100 per participant, exclusive of food and lodging, for a three- or five-day short course.

The details of the course are as follows:

LECTURER: Peter R. Rony, Department of Chemical Engineering, Virginia Polytechnic Institute and State University, Blacksburg, VA 24061 (703) 961-6370

TEXTBOOKS: Peter Rony, "Introductory Experiments in Digital Electronics and 8080A Microcomputer Programming and Interfacing, Books 1 and 2," Howard W. Sams & Co., Inc., 1977. Texas Instruments catalogue of digital chips. Intel catalogue of microprocessor and peripheral interface chips.

MICROCOMPUTER EQUIPMENT: E&L Instruments, Inc., MMD-1 8080A-based student trainer and E&L Instruments, Inc., DM-25 breadboarding station module. The MMD-1 is a very effective microcomputer for testing interface circuits in teaching and research laboratories. It is considered to be the "Rolls-Royce" of inexpensive microcomputer trainers (see Radio-Electronics magazine, May, 1981, pp. 46-47).

BACKGROUND REQUIRED: For the five-day short course, no background in electronics is required other than a knowledge of Ohm's law. For a three-day short course, a knowledge of digital electronics--specially the 7400-series of integrated circuits--is required.

WHAT WILL YOU LEARN?: (1) Basic concepts in digital electronics, such as gates, flip-flops, latches, three-state buffers, counters, decoders, demultiplexers, multiplexers, memories, shift registers, and arithmetic/logic units; (2) Breadboarding of 7400-series integrated circuits; (3) Fundamental microcomputer interfacing concepts, such as device select pulses, input, output, flags, data bus, control bus, address bus, interrupts, etc.; and (4) Introductory microcomputer programming concepts, such as byte, word, machine code, assembly language, register, stack pointer, program counter, accumulator, flags, subroutine, increment, decrement, store, load, move, immediate, AND, OR, Exclusive-OR, compare, add, subtract, input, output, push, pop, rotate, etc.

NUMBER OF LABORATORY STATIONS: Ten, with two participants per station.

COURSE DURATION: Preferably five days, possibly spanning a weekend. The assumption is that the participating faculty have no experience in digital electronics, and that a 1.5-day introduction to the subject is necessary.

SPECIAL TOPICS: A Z-89 personal computer will be demonstrated at course sites within driving distance from Blacksburg, VA. A simple computer "network" consisting of the Z-89 and the MMD-1 will be shown as an example of a common approach to microcomputer teaching and laboratory automation.

COURSE SITE SELECTION: A faculty member at the chosen site is needed to make arrangements for the lab and also for lodging for the faculty participants. Please keep lodging costs to a minimum. Perhaps a graduate student could be paid $100 to $200 for the week (to be pro-rated among the participants) to arrange for lodging and assist with various local details.

CORRESPONDENCE: To be handled from Virginia Tech. You make the local arrangements, and we will take care of the communication with faculty.

COSTS: The food, travel, lodging, and equipment wear-and-tear costs of the lecturer will be pro-rated among the participants and should be in the range of $35 to $75 per participant, assuming 20 participants. The cost of the two laboratory texts plus one or two handbooks (Texas Instruments and Intel) should be about $20 to $25 total.

PARTICIPANT DISTRIBUTION: One or, if there is room in the course, two participants from each chemical engineering department in a geographic region. The host institution--the one that makes local arrangements--can send two faculty members at no charge and allow any number of faculty and graduate students to listen to the daily lectures (assuming that there are enough seats in the lecture room). We are limited by the available equipment to approximately 20 participants per short course.

Individuals or groups interested in attending or helping to organize a course should contact Professor Rony.

PPDS (Physical Property Data Service) USER MANUAL COMPLETED

With financial support from DuPont and Simulation Sciences, Inc., CACHE has leased, from the British Institution of Chemical Engineers, through the efforts of Professor Rudy L. Motard of Washington University, a version of the PPDS physical property retrieval and estimation program. The service is now installed on a DEC System 20 computer at Carnegie-Mellon University and can be accessed via the TELENET communication network, which provides local dial-up service in most cities.

Professor Motard has completed a user manual for PPDS entitled "Introduction to CACHE Version of Physical Property Data Service." Copies of the manual can be ordered by using the order blank at the end of this newsletter.

The commercial version of PPDS provides retrieval of the following 17 constant and 15 variable properties, in a variety of units, including S.I. and British, for several hundred compounds:

Constant Properties	Variable Properties
Molecular Weight	Vapor Heat Capacity
Critical Temperature	Vapor Viscosity
Critical Pressure	Vapor Thermal Conductivity
Critical Volume	Liquid Heat Capacity
Melting Point	Liquid Viscosity
Normal Boiling Point	Liquid Thermal Conductivity
Parachor	Vapor Density
Heat of Formation of Vapor	Vapor Enthalpy
Heat of Formation of Liquid	Liquid Density
Flash Point	Liquid Expansion Coefficient
Lower Flammability Limit	Liquid Enthalpy
Upper Flammability Limit	Latent Heat of Vaporization
Autoignition Temperature	Liquid Surface Tension
Solubility Parameter	Vapor Pressure
Acentric Factor	Total Heat of Formation
Acentric Factor of Homomorph	
Dipole Moment	

The CACHE version of PPDS, when accessed from a terminal, can retrieve values of the above properties or support a FORTRAN-callable interface for user-written application programs for the following 50 compounds and/or mixtures thereof:

Hydrocarbons		Other Organic Compounds	Light Gases and Other Inorganic Compounds
Methane	Ethylene	Methanol	H_2
Ethane	Propene	Ethanol	N_2
Propane	Isobutene	Isobutyl alcohol	O_2
Isobutane	1-Butene	Acetic Acid	CO
n-Butane	Cyclopentane	Acetone	CO_2
Isopentane	Methylcyclopentane	Acetaldehyde	HCl
n-Pentane	Benzene	Ethyl acetate	Cl_2
n-Hexane	Toluene	Ethylene glycol	H_2S
n-Heptane	O-Xylene	Ethylene oxide	NH_3
2,2,4-Trimethylpentane	Ethylbenzene	Vinyl chloride	H_2O
n-Octane	Styrene	Chloromethane	
Acetylene	Naphthalene	Dichloromethane	
		Chloroform	
		Chloroethane	
		Acetic Anhydride	

Input to PPDS is interactive, wherein the user enters replies to questions from PPDS.

Output from PPDS consists of:

1. Tabulated, selected constant properties of pure compounds or mixtures.
2. Tabulated, selected variable properties of pure compounds or mixtures at specified intervals of T and P.
3. Warning messages for less reliable estimates.
4. Array values for user-written programs through FORTRAN interface.

In order to use CACHE-PPDS, contact:

Professor R. L. Motard
Department of Chemical Engineering
Washington University
St. Louis, MO 63130

He will send a contract and additional information. Upon receipt of the signed contract, a purchase order is sent to CACHE to cover an initiation fee of $100 for CACHE-sponsoring departments or $200 for non-sponsoring departments. This should be sent to:

CACHE
Room 3062 MEB
Salt Lake City, UT 84112

The approximate total cost to access CACHE-PPDS by TELENET is $5 per connect hour, payable to Carnegie-Mellon University.

CACHE SURVEY ON COMPUTER FACILITIES

In October, 1980, CACHE sent out a questionnaire to collect information on the status of modular instruction and computer facilities available to chemical engineering departments in the United States and abroad. The questionnaires were sent to 190 CACHE representatives. As of January, 1981, 42 responses had been received and analyzed.

In general, we received positive responses to the idea of computer-based modular instruction. Most departments were willing to use existing computer systems for module access and to appoint a faculty member or graduate assistant to administer the modular instruction.

Forty-three percent of the departments had access to PDP-11 computers, with about a fourth of these running UNIX. However, only 19 percent wanted to use PDP-11's for module access. Most departments had multi-user systems in mind, and there was a wide range of machines mentioned. At the top of the list were PDP-11's and IBM machines, but 17 different computers were included.

A vast majority of the computers could accept 1966 ANSI Standard FORTRAN. About half of the departments had Tektronix or Tektronix-emulating terminals, and at least 81 percent had simple alphanumeric CRT's. Only 21 percent reported having printers with graphics capabilities.

Below is a more detailed report of the survey. We hope that it provides you with helpful information as to what is going on in chemical engineering departments. If you need greater detail, please write Dr. David

Himmelblau at the Department of Chemical Engineering, University of Texas, Austin, TX 78712.

CACHE SURVEY ON COMPUTER FACILITIES

I. Modular Instruction

A. Are modular instruction materials currently used in chemical engineering classes at your university? 17% yes 83% no

B. If you had materials such as described in the attached letter, which of the following teaching modes would be used with such a system?

40% self-paced; 57% remedial; 36% text replacement.

C. Estimate how many classes would use the system if available for computer retrieval (via CRT's, printer, etc.) at your location.

0% 0; 79% 1-3; 19% more than 3.

D. Which topics would

1. you use 2. your department use:

29%	Material & Energy Balances	62%
45%	Process Control	43%
26%	Thermodynamics	43%
33%	Stagewise and Mass Transfer	50%
14%	Transport Phenomena	33%
36%	Kinetics	45%
36%	Equipment Design	43%

II. A. Which of the following computer systems would most likely be used for module access by your department?

50% 1. Your university's campus-wide interactive system.

33% 2. A smaller mini- or microcomputer system that is currently available

a. Within the chemical engineering department? 50% yes; 33% no.

b. Would the computer system used for module access be 0% Entirely dedicated to the use of the modules? 56% Used along with other teaching research activities?

17% 3. Either 1 or 2.

0% 4. No system available.

B. Would your department be willing to buy a recommended small system that could be devoted solely or partly to module access?

29% yes - Amount of money to spend:

7%	$0 - $2,000
12%	$2,000 - $5,000
7%	$5,000 - $10,000
—	$10,000 - $20,000
—	more than $20,000

55% no.

C. Could a

36% faculty member
17% staff member
40% graduate assistant

21% full-time
52% part-time

be assigned the responsibilities for operation of the system?
14% no.

D. Could a room be devoted exclusively or partly to system use?
33% yes; 42% part of room; 24% no.

E. Does your department have access to a PDO-11 computer system?
10% yes, running UNIX
14% yes, willing to run UNIX
19% yes, unwilling to run UNIX
57% no.

F. Please answer the remaining questions for the computer system you might have or might put together to retrieve modules, assuming you will use them.

1. If your computer system were to be used for CHEMI module access, would it be
10% single user only?
71% multi-user?

2. Type of computer:

19% PDP-11	5% Interdata
17% IBM	5% Prime
7% DEC	5% Z-80 based systems
7% Hewlett-Packard	2% ITEL
7% Univac	2% Siemens
5% CDC Cyber	2% Hitac
5% Data General Eclipse	2% Okitac

5% Data General Nova
2% Honeywell
5% VAX

3. Does the computer have a FORTRAN-IV compiler which will accept nearly all of the 1966 ANSI Standard FORTRAN?
88% Yes
2% No

4. What type(s) of terminals would be available for use to retrieve the modules? Please list the brands and models.

43% Tektronix
17% Tektronix emulator
7% Other graphics terminal
26% Alphanumeric CRT with form-ruling graphics character set
81% Simple alphanumeric CRT

5. What types(s) of printers would be available for use in module access?

33% Simple alphanumeric, upper case only
64% Simple alphanumeric, both upper and lower case
7% With graphics character set
14% With full point-plotting graphics

CHEMI CONTINUATION (PHASE II) PROJECT

Since October, 1979, the second phase of the CHEMI project, funded by NSF, has been underway with D. M. Himmelblau of the University of Texas at Austin as the Principal Investigator. A steering committee including the following was established in November, 1979:

Brice Carnahan, University of Michigan
Dean E. Griffith, Director of Continuing Education at
Oklahoma State University
Lee Harrisberger, University of Alabama
Vladimir Slamecka, School of Information and Computer Science, Georgia Institute of Technology
Robert Tinker, Technology Education Research Center, Cambridge, Massachusetts.

The main objective of the project is to make single-topic, stand-alone chemical engineering instructional modules available to students and practicing engineers on stand-alone, small computer systems. In addition, 500 abstracts referring to external sources of information on topics not covered by the modules are being prepared, and about 100 advanced-level modules for chemical engineering are being solicited.

The solicitation and preparation of modules is still continuing. The most recent, and last, editor to be appointed is Professor James Beckman, Department of Chemical and BioEngineering, Arizona State University, Tempe, Arizona 85281. He is in charge of the Design series of modules. Individuals who are interested in preparing modules for the Design series should contact Professor Beckman directly. Other editors who have gaps in their series and would be interested in hearing from prospective authors are:

Transport Phenomena:
Professor Ron Gordon
Dept of Chemical Engineering
University of Florida
Gainesville, FL 32611

Material & Energy Balances:
Professor Eric Snider
Div. of Resources Engineering
Dept of Chemical Engineering
University of Tulas
Tulsa, OK 74104

Thermodynamics:
Professor G. A. Mansoori
Dept of Energy Engineering
University of Illinois-
Chicago Circle
Box 4348
Chicago, IL 60680

Any prospective authors should contact the editors directly.

A number of advanced level modules and modules suitable for plant engineers are being prepared on the following subjects: 1) Process Synthesis, 2) Filtration, 3) Waste Water Treatment, 4) Economic Evaluation. Opportunities still exist for the preparation of a series of modules at the advanced level or modules suitable for continuing education. Contact D. M. Himmelblau, Dept of Chemical Engineering, The University of Texas, Austin, TX 78712, for further information if you would be interested in participating in this phase of the CHEMI Project.

Three sets of modules have been distributed for initial evaluation at various departments of chemical engineering. The modes of evaluation that are being used are either the self-paced mode or the remedial mode. Very

little interest seems to be exhibited in using the modules as a replacement for texts, particularly in view of the gaps that exist in some of the series of modules. Only the Process Control modules and the Material and Energy Balance modules have been evaluated extensively; one faculty member has evaluated the Stagewise and Mass Transfer modules. We are planning to evaluate the remainder of the modules once they have been installed on the computer and printed from the computer. Any of the CACHE representatives, or their colleagues, who would like to participate in the evaluation of the Transport series of modules and the Design series of modules should also contact Professor Himmelblau.

Work is proceeding at a slow pace on the preparation of a user inducement and self-assessment for the modules. Inasmuch as the modules will be retrieved from a computer data base, an extensive amount of programming has to be completed prior to adding the user information system to the existing set of modules.

We have planned on coding of the CHEMI information system in the C language. We had originally anticipated programming in FORTRAN so that the information system would be transportable from our facilities to those of other departments of chemical engineering. However, we discovered that there are so many discrepancies in even standard 1966 FORTRAN compilers that the C compilers will probably be more effective in enabling wide distribution and use of the CHEMI modules. Another reason for selecting C is that it is substantially easier to program the information system in C rather than in FORTRAN. The user inducement system and the information system will include some interaction testing (both pre-testing and post-testing), modification diagnostics for the user and for the system itself, and precedence order codes so that the individual can state a target module, an initiating module, and the best path between the two modules for purposes of study.

We are in the process of installing the UNIX operating system on the CACHE computer (located in the Department of Chemical Engineering at the University of Texas). Both the Material and Energy Balance and the Process Control series of modules have been entered into the CACHE computer, but they have not been implemented with superscripts, subscripts, chemical symbols, and Greek characters that are required for suitable display. We have not implemented the figures that must be embedded in the modules themselves. Future plans call for use of the GIGI system sold by the Digital Equipment Corporation. With the GIGI system, it will be possible to introduce all the suitable nonstandard characters, as well as the graphs, without the CHEMI Project being required to develop text editing programs and graphical software. Output will be displayed on a standard monitor (color is included at no extra charge) if the user has a GIGI terminal (cost $1600). We have decided that this is the most economical approach to entering the data into our database and retrieving the data from the database, both for the CHEMI Project and the ultimate user.

In the next few months, we plan to prepare a software demonstration program that illustrates the use of the information system, to design the information system and initiate coding of portions of the information system, to resolicit those modules to fill existing gaps, and to carry out an evaluation of the information system by letting students use it and test it.

RECENT ACTIVITIES OF GRAPHICS TASK FORCE

Under sponsorship of the NSF, a series of position papers on the impact of advanced technology on engineering education are being assembled. Professors Edgar, Mah, and Reklaitis of the CACHE Graphics task force have prepared a position paper entitled "Computer Graphics in the Chemical Engineering Curriculum." The paper deals with the following topics:

1. List of special factors pertaining to undergraduate education in chemical engineering. Among these are: large enrollments, decreased graduate enrollment, decrease in those selecting academic careers, budget constraints, etc.

2. Potential applications of computer graphics in the undergraduate program, including: simulated experiments, computer-aided instruction (CAI) involving classical graphical construction.

3. CAI involving chemical engineering problem-solving exercises.

4. CAI design systems for process design and control.

The task force has surveyed the present utilization of computer graphics in chemical

engineering education. This survey is an update of the 1979-80 survey, which appeared in the March 1981, issue of CEP. They have estimated needs of equipment and manpower in the field, including about four levels of computer graphics systems that could be used by academic departments. They have also discussed manpower and maintenance requirements and have made a proposal for implementation that consists of four items: 1) a program of matching funds for equipment grants, 2) a ChE computer-CAI software clearing house, 3) grants for the development of CAD and CAI courseware, and 4) a program of faculty training seminars.

The Graphics task force also reports that Vol. 5, No. 4 of the journal, Computers in Chemical Engineering will be a special issue on "Applications of Computer Graphics in Chemical Engineering. This special issue, due late this year will contain 11 papers:

1. "Practical Experience in Using Graphics in Teaching Process Analysis and Simulation," by D. Himmelblau
2. "The Use of Interactive Graphics-Based Software for Teaching Chemical Engineering Principles," by J. Calo and R. Andres
3. "The Use of the PLATO Computer System in Chemical Engineering," by C. Eckert et al.
4. "Educational Utilization of PLATO in Chemical Reaction Engineering," by M. Shacham and M. Cutlip
5. "Computer-Aided Process Control System Using Interactive Graphics," by T. Edgar et al.
6. "Computer-Aided Operability Analysis via Interactive Graphics," by W. Etzkorn and Y. Arkun
7. "GRIP: A Problem-Oriented Language," by R. Hilst and K. Bishop
8. "An Interactive Process Flowsheeting and Simulation System Based on Relational Data Structures," by S. Singh and B. Carnahan
9. "Computer-Aided Flowsheet Drawing: Equipment Layout," by G. Reklaitis et al.
10. "Computer-Aided Flowsheet Drawing: Stream Layout and Drawing," by G. Reklaitis et al.
11. "Interactive Image Processing in Research," by V. Schrodt and A. Saunders.

AICHEMI MODULAR INSTRUCTION SERIES AVAILABLE

AIChE has published the following six volumes of the AICHEMI Modular Instruction Series that were prepared by CACHE under the direction of Professor Ernest J. Henley of the University of Houston and William A. Heenan of Texas A and I University:

Series

A. Process Control
   I: "Analysis of Dynamic Systems," T. F. Edgar, Editor

B. Stagewise and Mass Transfer Operations
   I: "Binary Distillation," E. J. Henley, Editor

C. Transport
   I: "Momentum Transport and Fluid Flow," R. J. Gordon, Editor

D. Thermodynamics
   I: "Introduction to Thermodynamic Concepts, the Energy Balance, Volumetric Properties of Fluids and Heats of Reaction," B. M. Goodwin, Editor

E. Kinetics
   I: "Rates of Reaction, Batch, Mixed-Flow, and Plug-Flow Reactors," H. S. Fogler and B. L. Cyrnes, Editors

F. Material and Energy Balances
   I: "Introduction and Computations for Gases," D. M. Himmelblau, Editor

The modules were designed to be used for outside study, special projects, entire university courses, review courses, correspondence courses, continuing education courses, or to provide new and timely material that can supplement other courses. A tentative outline listing titles and authors of all modules appears in the volume distributed to all chemical engineering departments. The volumes are available from Publications Department, AIChE, 345 East 47 Street, New York, NY 10017, by single volume or by subscription.

CACHE AND CAST PLANNING FOCAPD-II CONFERENCE

From July 6-11, 1980, a very successful international conference entitled, "Foundations of Computer-Aided Chemical Process Design" (FOCAPD) was held at New England

College, Henniker, New Hampshire. Sponsored by AIChE and the Engineering Foundation and supported by the National Science Foundation, this first-of-its-kind conference was designed by Professors Richard S. H. Mah of Northwestern University and Warren D. Seider of the University of Pennsylvania to assess progress in computer-aided process design and to provide a forum for industrial practitioners to interact with researchers. The conference, whose proceeds were published in 1981, was attended by 146 participants from 16 different countries.

A second conference of this kind, FOCAPD-II, is now being planned by CACHE and the CAST Division of AIChE. Professor Arthur Westerberg of Carnegie-Mellon University and Dr. Henry Chien of Monsanto Company will serve as conference Chairman and Co-chairman, respectively. Tentative dates and location for the conference are June 19-24, 1983, at Snowmass, Colorado.

PROGRAMS FOR HAND-HELD PROGRAMMABLE CALCULATORS

The CACHE task force on Microcomputers and Hand-Held Calculators is continuing to collect chemical engineering programs written for hand-held programmable calculators to be published in booklet form. The proposed booklet to be published in 1982 will present unpublished programs of interest to chemical engineers and chemical engineering educators in the areas of:

Stagewise and Mass Transfer Operations
Transport
Thermodynamics
Kinetics
Material and Energy Balance
Design
Process Control

Abstracts of published programs, with references, will also be given. Material will be organized by subject and cross-referenced. If you have programs you would like to submit, please contact the Task Force subcommittee on hand-held programmable calculators.

F. William Kroesser, Task Force Subcommittee Chairman
Engineering and Science Division
West Virginia College of Graduate Studies
Institute, WV 25112
Phone (304) 768-9711, ext 453

FLOWTRAN NEWS

Almost seven years ago, Monsanto Company first made FLOWTRAN available through CACHE via the United Computing System (UCS) network for educational use. Since then, 57 schools in the United States have used FLOWTRAN.

CACHE has produced three books to assist educators in teaching FLOWTRAN. The first, "FLOWTRAN Simulation - An Introduction," is in its second edition. The second, "CACHE Use of FLOWTRAN on UCS," is currently being revised by L. T. Biegler and Professor R. R. Hughes of the University of Wisconsin. The third, "Exercises in Process Simulation Using FLOWTRAN," by J. Peter Clark, has been revised by T. P. Koehler under the direction of Professor Jude T. Sommerfeld at Georgia Tech. An order form for these books is included at the end of this newsletter.

FLOWTRAN has had a significant impact on chemical engineering education at a large number of schools. It has helped revive and interest in process design and modeling. Anyone interested in using FLOWTRAN can contact: Professor J. D. Seader, MEB 3062, University of Utah, Salt Lake City, UT 84112, (801) 581-6916. Questions regarding communication with the UCS network can be directed to the UCS representative for FLOWTRAN:

Ms. Carolyn Kuehl
United Computing Systems, Inc.
Suite 170
1030 Woodcrest Terrace Drive
St. Louis, MO 63141
(314) 434-6633

CACHE COMPUTER PROGRAMS FOR CHEMICAL ENGINEERING STILL AVAILABLE

In 1972, CACHE published seven volumes of "Computer Programs for Chemical Engineering." The volumes covered the following areas: Stoichiometry, Kinetics, Control, Transport, Thermodynamics, Design, and Stagewise Computations. Each volume contains descriptions and listings of from 11 to 24 tested FORTRAN programs prepared by eminent chemical engineering educators. The programs have proven useful for homework problems, classroom demonstrations, design laboratories, and process simulation. The seven volumes are still available individually at prices ranging from $12.95 to $14.95, and as a complete set at $89.95. Complete information on the volumes is available from the current publisher:

Sterling Swift Publishing Company
P. O. Box 188
Manchaca, TX 78652

CACHE REAL-TIME COMPUTING MONOGRAPHS AVAILABLE

In 1977, the CACHE Real-Time Computing Task Force, under the direction of Professor Duncan Mellichamp, prepared eight monographs on the following topics in Real-Time Computing:

MONOGRAPH I — AN INTRODUCTION TO REAL-TIME COMPUTING
- 0. Digital Computing and Real-Time Computing Digital Computing (Mellichamp)
- 1. The Structure of Real-Time Systems (Mellichamp)
- 2. An Overview of Real-Time Programming (Mellichamp)

MONOGRAPH II — PROCESSING, MEASUREMENTS, AND SIGNAL PROCESSING
- 3. Processes and Representative Applications (Edgar)
- 4. Measurements, Transmission, and Signal Processing (Wright)

MONOGRAPH III — INTRODUCTION TO DIGITAL ARITHMETIC AND HARDWARE
- 5. Representation of Information in a Digital Computer (Fisher and Seborg)
- 6a. Digital (Binary) Logic and Hardware (Engelberg and Howard)

MONOGRAPH IV — REAL-TIME DIGITAL SYSTEMS ARCHITECTURE
- 6b. Digital Computer Architecture (Engelberg and Howard)
- 7. Peripheral Devices and Data Communications (Rudd)
- 8. Digital Computer/Process Interfacing (Hughes)

MONOGRAPH V. — REAL-TIME SYSTEMS SOFTWARE
- 9. Assembly Language Programming (Fisher)
- 10. Utility or Systems Software (White)
- 11. Multitask Programming and Real-Time Operating Systems (Wright)

MONOGRAPH VI — REAL-TIME APPLICATIONS SOFTWARE
- 12. Real-Time BASIC (Mellichamp)
- 13. Real-Time FORTRAN (White)
- 14. Control-Oriented Languages (Smith)

MONOGRAPH VII — MANAGEMENT OF REAL-TIME COMPUTING FACILITIES
- 15. System Justification, Selection, and Installation (Smith)
- 16. System Operations Management and Program Documentation (McCarthy and Weaver)

MONOGRAPH VIII — PROCESS ANALYSIS, DATA ACQUISITION, AND CONTROL ACQUISITION, AND ALGORITHMS
- 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 number of universities and are available as single volumes at $3.75 and as complete sets at $28.00 from

Professor Brice Carnahan
CACHE Publications Committee
Chemical Engineering Department
University of Michigan
Ann Arbor, MI 48109

An order form appears on the last page of this newsletter.

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	Chairman
Data Management	Professor R. L. Motard Washington Unviersity
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
Real-Time	Professor D. A. Mellichamp University of California - Santa Barbara
Process Design Case Studies	Professor M. Morari University of Wisconsin-Madison

MICROCOMPUTER COURSEWARE

Interactive computer simulation and design modules in chemical engineering are being developed for use on the APPLE II Microcomputer. At this time, two modules have been completed. The first is a catalytic SO_2 oxidation simulation in a packed-bed reactor. This module allows the student to see how such parameters as temperature, pressure drop, and initial concentrations of reactants affect the conversion in the reactor. The second is a distillation design module, which contains both binary and multicomponent methods, including the Thiele-Geddes method for multicomponent distillations. This module allows the student to see how such parameters as number of trays, reflux ratio, and fluid conditions affect the quality of the separation. Associated with these modules is a microcomputer resident supervisory system to monitor execution of modules, maintain up-to-date records of students' progress and performance, and allow for on-line user evaluation of the materials presented in the modules. Further information about the modules and supervisory system can be obtained by writing to Professor H. Scott Fogler or Professor Brice Carnahan, Department of Chemical Engineering, University of Michigan, Engineering Bldg, Ann Arbor, MI 48109.

It is expected that additional modules in other areas (e.g., stoichiometry, fluid flow) will be prepared in the near future. Anyone wishing to participate in module preparation should contact Professor Fogler.

Order Forms for CACHE Publications

CACHE MONOGRAPH SERIES IN REAL-TIME COMPUTING

TO: Brice Carnahan, Chairman
CACHE Publications Committee
Chemical Engineering Department
University of Michigan
Ann Arbor, MI 48109

Please send me the following monographs at $3.75 per volume or $28.00 per complete set:

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University of Michigan
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Reply to Invitation to Attend
CACHE Representatives Luncheon
Ballroom A, Hyatt Regency Hotel
New Orleans, Louisiana
November 11, 1981, from noon to 1:30 p.m.

As CACHE Representative for my department:

__ I plan to attend the luncheon.

__ I cannot attend the luncheon.

__ _____ of our department will attend the luncheon in my place.

Name: _____

Department: _____

Mail this reply to: Professor Thomas F. Edgar
Department of Chemical Engineering
The University of Texas at Austin
Austin, Texas 78712