PARADIGMS IN ENGINEERING AND TECHNOLOGY EDUCATION

SECTION St-LAURENT
ASEE
St-LAWRENCE SECTION

ANNUAL MEETING
OCTOBER 1 & 2, 1993

ROCHESTER INSTITUTE OF TECHNOLOGY
ROCHESTER, NEW YORK

ST. LAWRENCE SECTION OF ASEE 1993 ANNUAL MEETING

HELD AT THE ROCHESTER INSTITUTE OF TECHNOLOGY

OCTOBER 1 AND 2, 1993

PROGRAM CHAIR
PROFESSOR VINNIE GUPTA
ROCHESTER INSTITUTE OF TECHNOLOGY

R·I·T

Rochester Institute of Technology

Department of Mechanical Engineering
James E. Gleason Building
76 Lomb Memorial Drive
Rochester, New York 14623-5604
716-475-2162 Fax 716-475-6879

October 1, 1993

Dear colleagues:

Welcome to the 1993 Annual Meeting of the St. Lawrence Section of American Society of Engineering Education (ASEE). Rochester Institute of Technology (RIT) is pleased to host this meeting. I hope you find it to be an enjoyable and enlightening meeting. If you need any assistance, please contact Tracey Brown at the registration desk.

PARKING: On Friday, please park your vehicle in the Visitor Parking Lot adjacent to the Center of Imaging Science (Building 76) -- the meeting site. On Saturday, you can use any parking lot on the campus.

NAME BADGE: Based on the registration information, on your name badge, a RED dot indicates Reception (04-Fireside Lounge), a BLUE dot indicates Banquet (04-CAU Cafeteria) and a Yellow dot indicates Lunch Box on Saturday (76-Lobby).

FACILITIES TOUR: Due to insufficient demand, formal tours of RIT Engineering and Technology laboratory facilities were canceled. However, on Friday at 3:15 pm, volunteers will be available at the registration desk to take you on an informal tour of Mechanical and Electrical Engineering/Technology laboratory facilities.

SATURDAY WORKSHOPS: We can accommodate many more participants in each of the two workshops: Solid Modeling on Unigraphics CAD and Electronic Design Automation using Analog Work Bench. Please meet at the registration desk and support staff will guide you to the appropriate laboratory area.

SPOUSE PROGRAM: Professor Santosh Kurinec is coordinating the spouse program. Please meet at 1:30 pm at the registration desk for a tour of Memorial Art Gallery (transportation and admission fee is included in the registration fee). On Saturday, please meet at 8:15 am in Radisson Inn Lobby for visiting the Marketplace Mall (transportation will be provided).

I hope the meeting will be personally rewarding to you and that you will enjoy our hospitality.

Sincerely,

Vinnie Gupta

Vinnie Gupta
Program Chair

AMERICAN SOCIETY FOR ENGINEERING EDUCATION
St. Lawrence Section - 1993 Annual Meeting
October 1 - 2, 1993 at Rochester Institute of Technology

Schedule

Friday, October 1, 1993

8:00 am - 5:00 pm	**Registration Desk** (76-Lobby)
8:30 am - 12 noon	**Workshop on Workshops** (76-1275) Richard Culver, SUNY at Binghamton
12 noon - 1:00 pm	**General Committee Meeting & Luncheon** (76-1275) Thomas Weber, SUNY at Buffalo
1:30 pm - 3:00 pm	**Welcome & Opening Remarks** (76-1125) Dean Paul Petersen, Rochester Institute of Technology **Keynote: Challenges & Opportunities in Engineering Education** Professor Nam Suh, Massachusetts Institute of Technology
3:00 pm - 3:15 pm	**Coffee Break** (76-Lobby)
3:15 pm - 5:00 pm	**Session IA: Engineering Education & Professional Societies (76-1125)** Moderator: Dean Paul Petersen, Rochester Institute of Technology **1. A new engineering paradigm for the 21st century ...** Dean Richard Kenyon, Union College **2. Necessary changes in engineering education** Dean Eleanor Baum, The Cooper Union **3. Current status and future plans of ASEE** Frank Huband, ASEE Executive Director **4. Enhancement of engineering education by professional societies** Carol Richardson, Rochester Institute of Technology **5. Integrated manufacturing studies at RIT** B. V. Karlekar, Rochester Institute of Technology
3:15 pm - 5:00 pm	**Session IB: Quality and Outcome Assessments** (76-1275) Moderator: Edward Schilling, Rochester Institute of Technology **1. Using the NYS Excelsior Award criteria for self-assessment in education** Donald Baker, Rochester Institute of Technology **2. [(What*How)*Who]*TQM: TQM in education** James Clum and Richard Culver, SUNY at Binghamton **3. Knowledge transfer: quality and innovation in service sector** John Earshen, SUNY at Buffalo **4. Technology transfer: its potential sources, its availability and ...** Nicola Berardi, SUNY Institute of Technology at Utica/Rome
5:30 pm - 7:00 pm	**Cocktail Reception: Open Bar and Appetizers** (04-Fireside Lounge)
7:00 pm - 9:30 pm	**Banquet** (04-CAU Cafeteria), **Award Ceremony** **Guest Speaker: Robert Johnston,** Rochester Institute of Technology

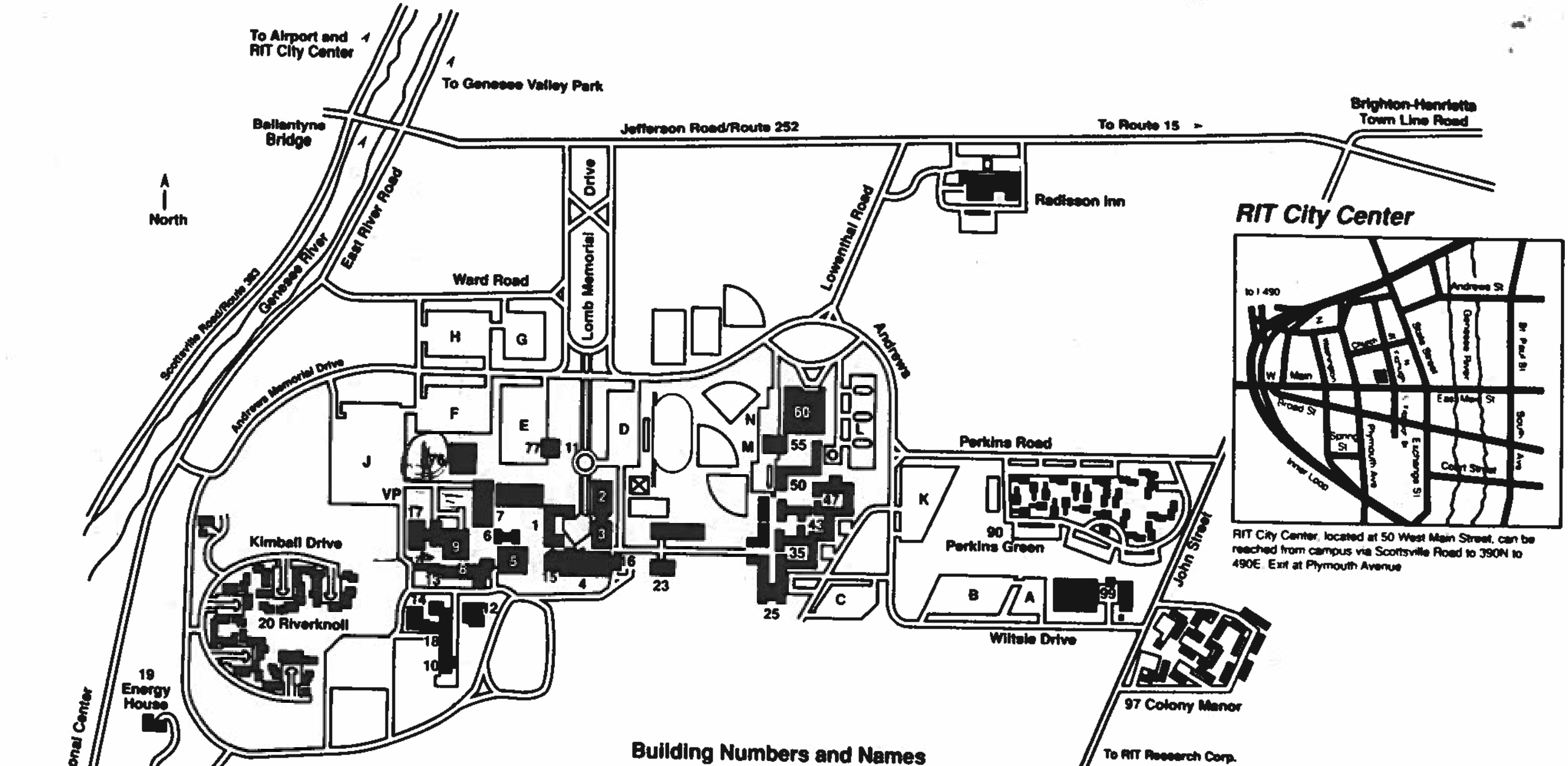
Saturday, October 2, 1993

8:00 am - 8:30 am	**Coffee and Donuts** (76-Lobby)
8:30 am - 10:15 am	**Session IIA: Distance Education and Multimedia** (76-1210) Moderator: Susan Rogers, Rochester Institute of Technology **1. Delivering site based extension programs in engineering technology** James Scudder, Rochester Institute of Technology **2. Multimedia case studies in Civil Engineering education** Gregory Deierlein, Cornell University **3. Calculus at a distance: A primer for the novice** Thomas Upson, Rochester Institute of Technology **4. Applied academics to revitalize America's adult workforce** William Beston, Broome Community College **5. ASM386-TASM386:Their interrelationships & instructional methodology** Nicola Berardi, SUNY Institute of Technology at Utica/Rome
8:30 am - 10:15 am	**Session IIB: Topics in Undergraduate Education** (76-1275) Moderator: Michael Ryan, SUNY at Buffalo **1. Use of personal computers in image processing education** Ronald Matteson, Rochester Institute of Technology **2. Computer exercises for electromagnetics** Richard Schwartz, SUNY at Binghamton **3. Problem solving tools in engineering** Robert Hefner and Vinnie Gupta, Rochester Institute of Technology **4. Restoration of speckle-degraded images: an REU project** M. R. Raghuveer, Rochester Institute of Technology **5. Teaching engineering modeling and design to engineering sophomores** Eugene Staiger, SUNY College of Technology at Alfred **6. Incorporation of design into core electronic laboratories** P. R. Mukund and Robert Spina, Rochester Institute of Technology
10:15 am - 10:30 am	**Coffee Break** (76-Lobby)
10:30 am - 12 noon	**Session IIIA: Design in Engineering and Technology Curricula** (76-1275) Moderator: Chris LeMaistre, Rensselaer Polytechnic Institute **1. A multi-discipline, capstone Senior Design course** Jon Freckelton and James Palmer, Rochester Institute of Technology **2. Creativity aided by systematic engineering design** W. Ernst Eder, Royal Military College of Canada **3. Computer aided mechanical design** Ti Lin Liu, Rochester Institute of Technology **4. Integration of design in core engineering** John Kolb, Rensselaer Polytechnic Institute **5. Prototype building in mechanical engineering design courses** Wayne Walter, Rochester Institute of Technology **6. Implementation of design in mechanical engineering program** Judith Dimitriu and M. A. Rosen, Ryerson Polytechnic Institute

10:30 am - 12 noon	**Session IIIB: High School Pipeline and the Freshmen Year** (76-1210) Moderator: Margaret Weeks, Corning Community College **1. Rochester Program in Mathematics, Science and Technology** Mary Gilbert, Rochester City School District **2. REEP: Comprehensive engineering entry program for grades 9-12** Paul Wojciechowski, Rochester Institute of Technology **3. On the development of First Year engineering design experiences** Barry Wills, University of Waterloo **4. Evolving engineering design curriculum at Alfred University** J. Rosiczkowski, Alfred University **5. Undergraduate academic advising initiatives** Richard Reeve, Rochester Institute of Technology **6. Role of solid modeling in engineering graphics** Donald Bunk, Rensselaer Polytechnic Institute
10:30 am - 12 noon	**Session IIIC: Mechanical and Electrical Design Workshops** (76-Lobby) Moderator: W. David Baker, Rochester Institute of Technology **1. Solid Modeling on Unigraphics CAD (09-2280)** M. Ramkumar, Rochester Institute of Technology **2. Electronic Design Automation using Analog Work Bench (09-3238)** George Zion, Rochester Institute of Technology
12 noon - 1:00 pm	**Business Meeting and Luncheon** (76-1275) Thomas Weber, SUNY at Buffalo **Collect boxed lunch from 76-Lobby**

SPOUSE PROGRAM

Friday: 1:30 pm - 4:30 pm	**Tour of Memorial Art Gallery** (meet in 76-Lobby).
Friday: 5:30 pm - 7:00 pm	**Cocktail Reception** (04-Fireside Lounge)
Friday: 7:00 pm - 9:30 pm	**Banquet, Award Ceremony & Guest Speaker** (04-CAU Cafeteria)
Saturday: 8:30 am - 11:30 am	**Visit MarketPlace Mall** (meet in Radisson - Lobby)
Saturday: 12 noon - 1:00 pm	**Collect boxed lunch from 76-Lobby**



Building Numbers and Names

1 **George Eastman Building:** Administration; Behavioral Science; Bursar; College of Continuing Education; Communications; Distance Learning; Government and Community Affairs; School of Food, Hotel, Travel Management; Packaging Science; Registrar; School Psychology; Social Work

2 **Frank Ritter Ice Arena**

3 **George H. Clark Gymnasium; Edith Woodward Pool**

4 **Student Alumni Union and Ingle Auditorium:** Alumni Relations; Ritskeller

5 **Wallace Library:** Instructional Media Services; Cary Library

6 **College of Liberal Arts**

7 **James E. Booth Building:** College of Imaging Arts and Sciences (School of Art and Design, School for American Crafts); Bevier Gallery; Webb Auditorium

7 **Frank E. Gannett Building:** College of Imaging Arts and Sciences (School of Photographic Arts and Sciences, School of Printing)

8 **College of Science**

9 **James E. Gleason Building:** College of Engineering; School of Engineering Technology

10 **Lewis P. Ross Building:** Information Systems and Computing; School of Computer Science and Information Technology

11 **Information Center**

12 **Max Lowenthal Building:** College of Business

13 **Facilities Office**

14 **Hugh L. Carey Building:** NTID; Center for Quality and Applied Statistics

15 **Campus Connections:** Bookstore

16 **Killian J. and Caroline F. Schmitt Interfaith Center**

17 **Center for Microelectronic and Computer Engineering**

18 **Link Building:** Information Technology; Telecommunications Technology

19 **Energy House**

20 **Riverknoll:** Campus apartment housing

23 **Hale-Andrews Student Life Center:** Physical Education; Athletics; Counseling Center; Student Health; SAISO; NTID Psychological Services

25 **Grace Watson Hall:** Resident dining facility; Campus Safety; Residence Life Office

35 **Kate Gleason, Eugene Colby, Frances Baker halls:** Residences

43 **Nathaniel Rochester, Helen Fish halls:** Residences

47 **Sol Heumann, Carleton Gibson halls:** Residences

50 **Mark Ellingson, Peter Peterson, Alexander Graham Bell halls:** NTID residences

55 **Hettie L. Shumway Dining Commons:** NTID residence dining facility

60 **Lyndon Baines Johnson Building:** NTID academics

76 **Chester F. Carlson Center for Imaging Science**

77 **Bausch & Lomb Center:** Admissions; Cooperative Education and Placement; Financial Aid; Part-time Enrollment Services; Veterans' Affairs

90 **Perkins Green:** Campus apartment housing

97 **Colony Manor:** Campus apartment housing

99 **Physical Plant buildings:** Central Supply; Mail and Reprographic Services; Operations Center; Purchasing; Receiving; Telecommunications

Keynote Speech

Challenges and Opportunities in Engineering Education

Nam P. Suh
Ralph E. and Eloise F. Cross Professor
Head, Mechanical Engineering Department
Massachusetts Institute of Technology
Cambridge, Massachusetts

We are witnessing a world in transition. Like any transition period, we are facing uncertainties, challenges and opportunities. Engineering schools must adjust their culture and educational programs to respond to the changing societal needs and aspirations. In this talk, a perspective on challenges and opportunities of engineering education will be presented.

Dr. Nam P. Suh, the Ralph E. and Eloise F. Cross Professor of Manufacturing and Professor of Mechanical Engineering, is the Head of the Department of Mechanical Engineering and the Director of the Manufacturing Institute at the Massachusetts Institute of Technology (MIT).

He has been on the faculty of the Institute since 1970. During this period he was the Founding Director of the MIT Laboratory for Manufacturing and Productivity (1977-1984), which has become one of the largest and most active research centers of its kind in the world. He was also the Founder and Director of the MIT-Industry Polymer Processing Program (1973-1984), Head of the mechanics and Material Division of the Mechanical Engineering Department (1975-1977), and a member of the Engineering Council of MIT (1980-1984 and 1991-to date).

From 1984 to 1988, Professor Suh, on leave from MIT, was the Assistant Director for Engineering at the National Science Foundation.

Session: IA

A New Engineering Education Paradigm for the Twenty First Century What Role for the Accreditation Board for Engineering and Technology?

Dean Richard A. Kenyon, P.E.
Union College
Schenectady, New York

Abstract:

It has been nearly four decades since the engineering science revolution swept the nation. Spurred on by "Sputnik," the recommendations of the Grinter study, and the scientific advances of the immediate post war years, engineering education in the United States underwent a dramatic transformation from a largely pragmatic, often empirical hands-on professional curriculum to a much more theoretical, rigorous and highly scientific program aimed less at industrial manufacturing and more at research and advanced development. Changes of the sort that took place in virtually every engineering program, both new and old, were long overdue and for the most part necessary and appropriate.

Forty years of evolutionary program refinements, however, have yielded an engineering curriculum in the mid 1990's, still based largely on the engineering science model of the mid-1950's, but now most likely overloaded with mathematics, science, and "current" technologies and perhaps, at the same time, woefully lacking in liberal learning, interpersonal skills development, and engineering practice orientation. Moreover, the increasingly constraining effects of the professional accreditation processes of ABET (and its predecessor ECPD) have led to an unfortunate conformity to detailed curricular specificity and near total homogenization of the engineering programs. The process of having imposed ever more detailed cirricular requirements has all but removed the opportunity for exercising creativity and innovation in the undergraduate program of study. This is a result quite in contrast with the wishes of the ECPD founders who stated emphatically that ECPD "has no authority to impose any restrictions or standardizations upon engineering colleges, not does it desire to do so." The founding fathers went on to say, "no hard and fast prescriptions are laid down for the curriculum . . . "

It is not unreasonable to conclude that much of the current unhappiness with ABET and its accreditation program on the part of university presidents and engineering deans stems from this perceived (and perhaps all too real) intrusion by an outside agency in what should be the prerogatives of the institution and its faculty. There are few who would disagree with the notion that major change in the basic engineering curriculum is overdue. There is far less agreement on what the nature of the change should be. So long, however, as the accreditation process is perceived to continue to constrain engineering education to a single model any real change will be difficult to implement. The challenge to the profession, and particularly to those who value and participate in the voluntary accreditation process of ABET, is to find a way to recognize and proclaim quality in engineering education without imposing standardizations that lead to uniformity and even mediocrity.

This paper deals with some of the changes already underway and those that still need to be considered in the accreditation system in order for ABET to become, as the ECPD founders intended back in the early 1930's, an organization that "aims to preserve the independence of action of individual institutions and to promote the general advancement of engineering education thereby." For over forty-five years, it has been a guiding principle of ECPD and ABET "to avoid rigid standards as a basis for accreditation in order to prevent standardization or ossification of engineering education and to encourage well-planned experimentation." We need to reaffirm and implement this fundamental principle and to do so quickly so that the next revolution in engineering education may begin.

Session: IA

Necessary Changes in Engineering Education

Dean Eleanor Baum
Albert Nerken School of Engineering
The Cooper Union
New York, New York

This next decade offers enormous challenges to engineering education and, therefore, to engineering educators. Both the economics of this nation and changes in the international picture require a careful look at the traditional engineering education process. We need to look at the curricula for both graduates and undergraduates, laboratory experiences, design experiences, internationalization of the curricula, integration of new educational technologies and ways of dealing with a changing student body. We need to seriously address lifelong learning for engineers, consumer satisfaction of our universities and encourgement of faculty to expend time and energy to confront these challenges.

The National Research Council's Board on Engineering Education has been meeting and discussing many of these issues. The speaker will give her perspective of the work of the Board and some of her own suggestions.

Session: IA

The Enhancement of Engineering Education by Professional Engineering Societies

Carol A. Richardson
Director, Telecommunications Technology
Rochester Institute of Technology
Rochester, New York

Abstract:

This paper discusses some of the roles that professional engineering societies are presently playing in the lives of faculty, students, and institutions. Professional engineering societies can aid the growth of junior engineering faculty members, engineering students, and the programs at the associated universities or colleges. Examples of how these societies are presently helping to fill the engineering pipeline and enhance the development of programs and students during the current era of decreased program funding are sited.

Professor Balwant Karlekar
Center for Integrated Manufacturing Studies
Rochester Institute of Technology
Rochester, New York

RIT's Center for Integrated Manufacturing Studies is an industry, academic and government initiative with the focus on helping small and medium size manufacturing firms through Assessments, Problem Solving, Technology Transfer, Education, Seminars/Workshops, and Demonstrations. CIMS' focus is to look at a manufacturing enterprise in a holistic, integrated fashion taking into account all facets of manufacturing and business. CIMS is a multidisciplinary applied research, training and education center. The center will be housed in an approximately 157,000 sq. ft. building on the RIT campus. The concept of CIMS entails real time manufacturing bays or teaching factories in disciplines: such as electronics, imaging, printing and publishing, advanced materials, and mechatronics. These activities will be supported by technical laboratories in the areas of Advanced Materials, Advanced Manufacturing, Process Planning and Control, Quality and Reliability, and Information Systems and Management. The Center will have modern training rooms equipped with video, audio, and data links for technology transfer purposes.

RIT's vision for the Center for Integrated Manufacturing Studies focuses on applied research, adaptation and adoption of results of research in the manufacturing enterprise, technology transfer, and utilization of RIT's manufacturing-related undergraduate and graduate programs. Specifically, the mission of CIMS is to:

1. Overcome the barriers between basic research and technological innovation through its faculty and its dedicated manufacturing and testing laboratories. As a result, CIMS expects to produce managerial and technological innovations that will solve problems which impede competitiveness now and in the future.

2. Adopt innovative technologies to real-time production environments and more effectively manage existing technologies toward incremental product and improvements.

3. Support current and future manufacturing-oriented undergraduate and graduate programs and contribute to them, by providing an innovated, laboratory base to prepare students for integrated managerial and technological roles in industry.

4. Disseminate information through a strong training capability, reaching out to manufacturing sector and helping it make full use of current and emerging technologies.

This holistic, comprehensive, and pragmatic approach of CIMS to research, practice, and transferring knowledge to the manufacturing sector has its roots in RIT's 160 year tradition of serving business and industry and of addressing national human resource needs through its career-oriented educational programs.

Session: IB

Using the NYS Excelsior Award Criteria for Self-Assessment in Education

Donald D. Baker
Associate Director & Manager of Professional Programs
Center for Quality and Applied Statistics
Rochester Institute of Technology
Rochester, New York

The NYS Excelsior Award, now in its third cycle, is being recognized as the lading state award for quality. The award was the first to recognize quality in three sectors: Private, Public, and Education. The award also placed special emphasis on the workforce and on labor-management cooperation.

Patterned after the Malcolm Baldrige National Quality Award criteria, the award requires visionary leadership, a commitment to customer satisfaction, an empowered and well-trained workforce, and quality results. A separate application guideline has been developed for each sector, providing a road map for interpreting the criteria for organizations in different sectors of the economy.

This session will briefly review the history and development of the Excelsior Award; define the seven major categories in the award: Leadership, Information and Analysis, Strategic Quality Planning, Human Resource Excellence, Management of Process Quality, Quality and Operational Results, and Student and Customer Focus and Satisfaction; and discuss the differences between the private and education applications. In addition, a new Excelsior publication, The Starter Guide, for use in pre-assessments, will be introduced.

[(What*How)*Who] = TQM

TQM in Education

James A. Clum and Richard S. Culver
Mechanical and Industrial Engineering Department
State University of New York
Binghamton, New York

Abstract:

Purposeful changes in the What (content) and How (pedagogical methods) of teaching have been undertaken in the classroom using TQM methods to improve end-of-course ratings. However, less thought has been given to the intellectual development of the Who, i.e. the students involved in TQM-based courses. In particular, there has been a lack of reports identifying the "value added" to the students' education, in terms of changing knowledge, skills, and attitudes.

This paper will look at the opportunities provided by identifying the role of learner characteristics (ie. Who they are) in establishing both the content (What) and methods (How) of presentation so that the goal of creating a skilled, self-motivated learner might be achieved. Various instruments and techniques for measuring the Who will be discussed, with particular attention to the Myers-Briggs Type Indicator (MBTI) and the Technical Students Learning Environment Preferences (TSLEP) questionnaire. Data using these two instruments for measuring learner characteristics will be provided.

Session: IB

Knowledge Transfer: Quality and Innovation in the Service Sector

John J. Earshen
Assistant Professor
Department of Technology
SUNY College at Buffalo
Buffalo, New York

Abstract:

As engineering and technology educators, our curricula have traditionally focused on manufacturing, production and materials. While manufacturing will probably always hold strategic importance in our domestic economy, the service sector continues to grow in relative size and significance. It follows that we can expect an increasing demand for technically competent graduates who are able to provide strong leadership within the service sector. In service areas such as health care, education and government, for example, the problems of poor quality, waste and inefficiency are ubiquitous. Yet, few conceptual bridges have been built within our curricula to help our graduates transfer successful "quality management" and "continuous improvement" principles to the service institutions. Many future engineering and technology program graduates and their service sector employers would therefore benefit by the inclusion of service sector considerations in the study of quality and management. In the service sector, the need for innovation technical managers has never been stronger.

In comparison to their "for-profit" counterparts, service sector institution managers have been relatively slow to recognize the centrality of innovation and TQM to the solution of mounting organization-wide problems. Yet, today the very survival of a hospital, school, government agency, professional organization or community organization may well depend upon the ability of its leadership to encourage the organization to reframe itself based on principles of innovation and total quality, often in the face of considerable resistance. Highly prized in any organization are those individuals able to manage innovation and quality effectively. With a slight modification in curricular design, today's engineers and technologists will be particularly well-suited to grapple with the economic, social and technological pressures that face service sector organizations. This presentation argues for (and will give examples of) how engineering and technology programs can integrate service sector considerations into the curricula.

Session: IB

Technology Transfer:
Its Potential Sources, Its Availability and Its Impact on Rehabilitation

Nicola Berardi, P.E.
Associate Professor
Electrical Engineering Technology Department
S.U.N.Y. Institute of Technology
Utica, New York

Abstract:

All societies, at one time or another, are confronted by problems. Some of them will display lethargy by refusing to take any action--setting a regressive pattern--while others attempt logical solutions. What truly differentiates societies is not the magnitude of their problems, but their personal and technical resolve to seek a solution.

In all aspects of rehabilitation, technology is the next field of battle for the solution of numerous problems. In conjunction with therapists and education, technology has become one of rehabilitation's most effective weapons. However, technology can only be useful if properly adapted to the needs of its user. The adaptation of said technology can only be possible or effective if it is based on clearly stated requirements and constraints; the latter are easily identified by those who man the battle stations: the therapists, the social workers, the psychologists, the doctors or other care givers.

Engineering applications, because of their nature, are important tools necessary to overcome the difficulties encountered by disabled persons. However, by virtue of their personal and professional experiences, only the related care givers can assure the success of technology applications, by enlightening engineers in all endeavors (research, design and implementation) of adaptive mechanisms. Thus a new interdisciplinary relationship must be initiated, such that, care givers' experiences will greatly impact on the engineers' problem-solving decisions.

SUNY Institute of Technology is presently cooperating with Rome Developmental Disabilities Services Office on a joint venture of Transfer of Technology, that will benefit all parties involved. The estimated outcome includes an ever increasing awareness and involvement by faculty and students. This, in turn, will help create an environment conducive to enlightened applications of any available technology, for use by either the care giver or the disabled.

Session: IIA

Delivering Site Based Extension Programs in Engineering Technology

James F. Scudder
Associate Director
School of Engineering Technology
Rochester Institute of Technology
Rochester, New York

Abstract:

The School of Engineering Technology at RIT has been involved in the delivery of upper division engineering technology programs at extension sites for many years. Initially, these programs were delivered using a combination of adjunct faculty who were hired locally, and RIT faculty who traveled to various sites. As new technology became available, lectures have been delivered by video tapes, and electronic blackboards have been used for recitation. Many laboratories are run with conventional techniques at remote locations, but where facilities at the extension location are inadequate, multiple experiments are run during extended Saturday labs in Rochester.

In 1990 the General Motors Technical Education Program approached RIT with a request for an interdisciplinary B.S. program in engineering technology to be delivered on-site at several plants simultaneously. This program needed to be flexible enough to allow students with various backgrounds to complete a bachelor's degree, but yet retain the rigor needed to provide proper preparation for professional employment. To accommodate this need, a new Bachelor of Science program in Electrical/Mechanical Technology was developed. This program was approved by New York State Education Department in 1992, and the first students completed the degree requirements in 1993.

Video tape delay courses have been offered in mathematics (College Algebra, Calculus, Statistics and Differential Equations), chemistry, and technology (Mechanics, Materials Science, Electronics, Thermal Science, and Manufacturing Management). Programs and courses are site based distance learning, and are currently running at six community colleges in New York State and up to eight General Motors sites in Michigan, Arizona and Colorado. These programs are offered in cycles, i.e. a cohort of students at a site completes one cycle of courses before another group of students is admitted into the program.

Session: IIA

Multimedia Case Studies in Civil Engineering Education

Gregory G. Deierlein, Richard N. White and Mark L. Valenzuela
School of Civil & Environmental Engineering
Cornell University
Ithaca, New York

Abstract:

During the last two years, the authors have been working on a project sponsored by the NSF Synthesis Engineering Education Coalition to improve engineering education by introducing design concepts through the use of case studies of actual projects. A central component of this work has been the development of a multimedia system to facilitate storage and access to materials and supporting information for presenting case studies. The multimedia system and case studies developed through this project have been successfully used in several undergraduate courses in structural engineering at Cornell University.

The proposed presentation at the ASEE Annual Meeting would be to provide an overview of (1) the motivation for introducing engineering case studies within the current curriculum, (2) the development and use of a Macintosh based multimedia system for developing and presenting case study lectures, and (3) the authors experiences in using the case studies and multimedia technology in the classroom. Depending on the available time and format of the sessions, the presentation could include a demonstration of the multimedia system.

Session: IIA

Calculus at a Distance: A Primer for the Novice

Professor Thomas C. Upson
Mathematics Department
Rochester Institute of Technology
Rochester, New York

This paper addresses the issues surrounding the design of a first year university level Calculus course offered to students in three distinct distance educational environmental environments: rural high school students; individual telecourse students; students in a corporate training program. The overriding concern of the faculty was that each of the students achieve their goals and feel a part of an educational community while not being at the same place at the same time as the faculty. Budgetary and other constraints limited the choices in the design of the delivery systems. A different blend of videotape, audio, audio-graphic, and computer conferencing was chosen for the various populations.

Each of the student populations brought with them a variety of strengths, weaknesses and expectations. They differed in their educational and emotional maturity, educational backgrounds and skills, motivation, and levels of individual initiative and discipline. It was found weakness in one area was more than compensated for by strength in others, provided appropriate support was given each group and student.

A challenge for the future is to include in the course the opportunity for these diverse populations to interact and learn from each other. For example, the corporate employee sees immediate application of the mathematics to the work of those with whom he works. Sharing this with high school students would give them a greater feel for the relevance of their studies. The older student would also gain through this type of peer/mentor relationship.

Corporate Training & Tech Prep
A successful program at Universal Instruments using "Applied Academics" to revitalize America's adult workforce

Dean William Beston
Technologies, Engineering & Computing
Broom Community College
Binghamton, New York

"More than half of our young people leave school without the knowledge or foundation required to find and hold a job." U.S. Department of Labor, 1991.

This report is contrasted with employers everywhere demanding higher performance from the American workforce.

In response, the United States is engaged in a major education reform movement aimed at providing continuity of learning and quality educational opportunities for all students. This movement called Tech Prep challenges students and effectively prepares them to live and work in a highly technological society. Tech Prep will provide the type of work force our nation needs to compete in a global economy. "Applied Academics" in mathematics, science, and communications form the strong academic foundation for the Tech Prep curriculum which will enable students to understand complex technologies and new skill requirements in work environments. The programs prepare students for high-skill technical occupations and allows direct entry into the workplace after high school graduation or continuation of study leading to an Associate Degree at a two-year college.

The same Tech Prep concept can be adapted for use in an industrial setting for current employees. One recent training program has been developed by the Greater Broome Tech Prep Consortium, Broom Community College, and Universal Instruments, a subsidiary of Dover Electronics. Universal manufactures automation equipment for electronic manufacturing assembly and testing of electronic circuits, software, and computer-controlled electronics manufacturing equipment. This partnership has produced a non-credit Certificate Program in Applied Technology. This pilot program is initially targeted to Universal employees, without college degrees, holding technical positions in manufacturing, fabrication, and engineering. Successful completion of this six-course program (in mathematics, principles of technology, communications, and problem solving) will prepare the employee to enter one of several Associate in Technology degree programs at Broome Community College. The Applied Technology program is one means of helping to ensure that Universal Instruments retains a competent and skilled work force. This model is one that can easily be replicated, on-site, at a variety of companies throughout the region. It will prepare employees and companies to diversify manufacturing lines and strengthen strategies for continuous improvement within an organization.

This session will discuss in detail the six course sequence and how UI employees are selected, tested, and placed in the program. The placement exam, criteria for placement, and program outcomes will also be included.

Session: IIA

ASM386--TASM386: Their Inter-relationship and Instructional Methodology

Nicola Berardi, P.E.
Associate Professor
Electrical Engineering Department
S.U.N.Y. Institute of Technology
Utica, New York

Abstract:

High level languages, such as Pascal, Fortran, APL, etc. and Mid-level languages such as C, PLM, etc. are very powerful tools, in that they allow a programmer to read, write, enter or display numeric values more directly. Assembly languages, though lacking similar abilities, provide a detailed insight of the workings of a microprocessor as it executes every instruction. This feature is very desirable when endeavoring in the implementation of design applications based on microprocessors. Assembly languages can and, in fact, become the important tool used to test, analyze and simulate the operational conditions directly related to a system's operations.

The ASM386 and/or TASM386 assembly languages, in conjunction with DOS and BIOS functions, are very effective in all aspects of modeling and simulation of the physical characteristics that are inherent to a system based on designs using an Intel 80386 32-bit CPU. This native language allows for convenient viewing of the internal processes, as adopted by the CPU, for data transfer and/or manipulation. In operations where number-crunching is of the essence, the importance of a Numeric Processor such as the Intel 80387 Floating Point CPU becomes even more evident when attempting to formulate an algorithm that needs to take into consideration real numbers and complex functions, at a very high degree of accuracy.

The examples presented underline the importance of the instructional steps used to move from the basic algorithm in ASM386 or TASM386, to one using DOS and/or BIOS calls for the purpose of friendly interaction with a personal computer.

Session: IIB

Use of Personal Computers in Image Processing Education

Professor Ronald G. Matteson
Computer Engineering Department
Rochester Institute of Technology
Rochester, New York

Abstract:

In the Department of Computer Engineering at Rochester Institute of Technology, personal computers are extensively used in courses titled "Document Image Processing" and "Image Processing Algorithms." Until recently, the displays of personal computers were of lower resolution, and images of television resolution or better could not be displayed effectively. The approach then was to use two displays, one for the images, and one for the computer. This was a fairly expensive approach, since framegrabber adapter boards were required for the PC's, and complex software had to be written to provide certain utilities to students before they could write image processing software.

The software utilities were incorporated in a package called Image Processing System (IPS), and required about one man-year of software development. The utilities included such things as Load/Save image from/to disk. Output image to printer, Input image from TV camera or scanner. Copy image to other side of display, etc.

Students would access images in the framegrabber memory, which meant that they had to learn the memory structure, and had to supply the appropriate values to the framegrabber control registers.

With the advent of Super VGA displays, it became possible to display two 512 by 512 pixel images directly on the PC display. The instructor wrote a "template" program, which did the disk accessing and display of the images. The students were required to write various kinds of image processing routines, keyed to the course material, and insert these routines in the template. The software was then debugged, demonstrated to the instructor, and described in a report. The student projects included spatial filtering, histogram enhancement, spline interpolation, homogeneous transformations, halftoning, quad tree encoding, morphological image processing, and a final project of their own choosing. These final projects have included JPEG compression, halftone optimization, edge enhancement, adaptive threshholding, file format conversion, etc.

With PC computing power that is now available and the higher resolution displays, it is easier for students to do projects more directly related to the course work, and there is a shorter startup time for them to do useful work. In addition, the cost of PC's is continuing to go down fast, so that the capital investment for a small PC lab is not great.

For image processing, we find that a 17-inch display is the minimum useful size, which runs the cost up a little more than most PC's. Another difficulty that is faced is determining the details of the SVGA monitor adapter boards so

that they can be put into the appropriate modes for gray-scale image processing. Unfortunately, there are no SVGA standards on such things, so the software depends on the particular vendor supplying the adapter board. The required software is the "template" program supplied to students, however, so that the students need not be concerned about the details of controlling the adapter.

The courses, then, can provide a good mix of theory, C-programming experience, and laboratory experiments which give students practical examples of manipulating real images.

Session: IIB

Computer Exercises for Electromagnetics

Professor Richard F. Schwartz
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Binghamton, New York

Abstract:

Electromagnetic theory has long been one of the most unpopular subjects studied by electrical engineering students. The reasons for this are that it seems too abstract and too mathematical, requires dozens of new entities to be defined, labeled, and remembered, and introduces too many laws which seem to have little practical significance (to the students). The study of transmission lines, waveguides, and antennas normally fare slightly better in students' estimates, but still are not popular subjects.

The computer has brought a new dimension to these subjects, with some positive effects in generating interest and even enthusiasm. Today's computer-literate students can explore the way in which the various laws describe the field vectors and potentials and can also apply some of the special techniques such as relaxation and the method of moments to problems. Finally, there are starting to be many applications programs available than can form the basis of assignments for students. With some of these, design problems requiring varying parameters to obtain the closest satisfaction of a set of performance criteria can be assigned.

Use of a spreadsheet by the instructor allows not only the keeping of a running tally of grades, but also allows assignment of some problems in which each member of the class has a different set of parameters with which to work.

The paper describes the ways in which the author has used the computer in teaching electromagnetics, transmission lines, waveguides, and antennas. Examples are given from the areas of electrostatics, magnetostatics, time-varying fields, transmission lines, waveguides, and antennas. Various text books incorporating computer programs and assignments are noted.

Session: IIB

Problem Solving Tools in Engineering

Robert Hefner and Vinnie Gupta
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Rochester Institute of Technology
Rochester, New York

Traditional engineering curricula concentrate on educating the student in the theory and problem solving techniques of specific engineering sciences. Typically the mathematics required for application of these engineering specialties result in assigning problems that are either realistic but uniquely constrained or are trivial to demonstrate parametric variation. Courses in higher level computer languages and numerical computational methods have been common in most engineering curricula with the wide spread availability of computers to enable solving computationally lengthy problems. However, the typical undergraduate is not sufficiently proficient in these computer techniques to apply them to complex problems.

The current availability of very powerful generic and specialty computer programs has largely eliminated the need for the undergraduate to develop unique programs using a high level language. The application of these user friendly generic programs enable a more interdisciplinary approach to problem solving as well as illustrating the effects of parametric variations in realistic mathematical models of engineering problems. At RIT the Mechanical Engineering curriculum is being modified to take advantage of these tools in revitalizing a three course sequence in numerical computations.

Session: IIB

Restoration of Speckle-Degraded Images: A Project Under the Research Experience for Undergraduate Program

M.R. Raghuveer
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Rochester Institute of Technology
Rochester, New York

Abstract:

The results of the project: "Reduction of Speckle in Coherent Imaging Systems," funded by the NSF under the Research Experience for Undergraduate (REU) program, is described here. Speckled images arise in situations where an object is illuminated by coherent radiation and the object's surface is rough on the order of a wavelength. This phenomenon is seen in many situations of practical interest such as ultrasound imaging, RADAR, SONAR, laser and maser imaging. While there are applications where the speckle conveys information about the object being illuminated, such as the surface roughness, it limits the resolution of the final image. Therefore, when the goal is to obtain an image of clarity, speckle is regarded as an interfering phenomenon. Several attempts have been made to reduce the effects of speckle. Most rely on modeling speckle as multiplicative noise. In this model, a logarithmic transformation would result in this multiplicative noise being converted to additive noise. If the object is merged with an aperture whose size is larger than the size of the speckle but is small enough to preserve image detail, the distribution of this additive noise can be approximated as being Gaussian. Thus, as this paper shows, given a translating object imaged in coherent illumination by an aperture, we could use the logarithmic transformation along with properties of the bispectrum (The Fourier transform of the triple correlation) to mitigate the effects of speckle and reconstruct the object.

Session: IIB

Teaching Engineering Modeling and Design to Engineering Science Sophomore Students

Professor Eugene H. Staiger
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SUNY College of Technology
Alfred, New York

Abstract:

The main teaching vehicle is three, four-week design projects assigned to teams of four students. The course focuses on realistic, open-ended engineering problems designed to illustrate the interrelations between engineering disciplines. Students are introduced to the engineering design process and the project management process concurrently. They are expected to apply these processes and the skills and knowledge acquired in other engineering science courses to the design problem. The final projects are obtained from practicing engineers who serve as a client. The two-lecture, one-lab per week course is required for fourth semester Engineering Science students.

This paper will present the student objectives and topical outline as an overview of the course. More important topics such as team formation and team dynamics, design problem selection, student accountability and grades, the question of handouts versus textbook, topics which are difficult to teach (generally these are processes), are recommended study references will be highlighted.

Session: IIB

Incorporation of Design into Core Electronic Laboratories

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Rochester, New York

The importance of making core electronics laboratories design oriented has been recently stressed in various forums including ABET requirements. The EE department at RIT has made a major move in this direction by delinking the core electronic laboratories from the theory courses. The core laboratories are three courses of one credit hour each. The assignments in this core laboratory sequency start from simple measurement assignments and culminate in a fairly complex amplifier design. Video tapes and hypercard based tutorials have been developed to enhance the laboratory experience for the student. This paper will outline the course contents and the teaching methodologies used in this context.

Session: IIIA

A College Level, Multi-Discipline, Capstone Senior Design Course

Jon E. Freckleton and James Palmer
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Rochester Institute of Technology
Rochester, New York

Abstract:

Founded on a three year trial of informally supporting projects that could not be accomplished by mechanical engineers, based on their course work, a college level course is being offered on a limited basis for the 93/94 academic year. Over the past three years, several mechanical engineering senior design teams have needed additional engineering from electrical engineers, industrial engineers, or industrial designers. This was accomplished through student friendship, faculty friendship, or "desperate begging" to classes of students in the needed discipline. Results were excellent from two standpoints. First, the actual technical result; and second the student feedback regarding the great benefit of working with and depending on engineers from a different department or college.

The current mechanical engineering sequence requires two quarters to complete. It is a fifth year required course. The first quarter teaches several subjects such as PERT planning and has a deliverable of a project proposal. The second quarter requires a working prototype. With very few exceptions, the projects are industry sponsored, solving "real" problems.

The new course will have carefully selected, industry sponsored projects. The key to these projects is that they must involve at least three departments. There will be advisors from each department. Many of the lectures will be common with the mechanical engineering course. A significant number of outside speakers are involved and the desire is to not lose the commitment of this support by doubling the number of visits. The course will retain the current requirement of delivering a working prototype. It will add instruction in group dynamics and will provide practical knowledge of other engineering fields.

Session: IIIA

Creativity Aided by Systematic Engineering Design

Professor W. Ernst Eder
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Royal Military College of Canada
Kingston, Ontario

Abstract:

Factors that influence creativity include those concerning individual people, who require a combination of:

--an adequate knowledge of objects and principles, including scientific and tacit knowledge, heuristics and gut feelings;
--a knowledge of processes, especially (tacit and/or explicit) knowledge about design and problem-solving processes, and different ways of modelling objects (products and processes);
--adequate judgement, a sense of what is reasonable to expect;
--an open-minded attitude, willingness to accept ideas (self-generated or offered by others) and to associate them with other knowledge;
--sufficient motivation, including self-motivation (inspiration) and externally induced motivation (rewards);
--ability to communicate to make the generated proposals visible;
--level of stress, including effects of possible pressure of time or unsuitable management conditions.

It is probably because of this composition and the variability among persons that psychological instruments to test for "creativity" seem so inconclusive.

Other factors of effective creativity concern group interactions, which shows needs for team building, choice of the mix of psychological make-up of members and development of their inter-personal skills. Further considerations involve management of the design process, progressing to develop solutions, documentation, acquisition of information, etc.

Procedural aspects of designing include an apparent contradiction. One side demands freedom of expression. The other industry-expressed side shows a need for the work of professionals (engineering designers) to be rendered verifiable so that procedures and results are open to review and discussion.

It is acknowledged that such a systematic approach is "not the way that engineering designers work." How can systematic work be expected, when:

(a) designers generally do not know about existing systematic approaches;
(b) they have already internalized their own approaches to such an extent that they can no longer discuss and explain their intuitive actions;
(c) their procedures are adequate in most instances, they have no incentive to change and their problems are largely routine;
(d) systematic approaches published elsewhere (e.g. Europe) are actively denigrated in the North American design research literature?

An example, redesigning a globe valve for different conditions, shows that the two sides of the apparent contradiction are in fact fully compatible. It also shows that the kinds of knowledge listed above have a direct bearing on engineering design. Furthermore, it demonstrates that creativity can result from a systematic approach, and the likelihood of obtaining a "best" solution can be increased by systematic work.

In addition, the systematic approach demonstrated in the example makes engineering design fully learnable, and provides a complete context to design, including industrial, societal, economic and other factors.

Session: IIIA

Computer Aided Mechanical Design

Ti Lin Liu
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Mechanical Engineering Technology Department
Rochester Institute of Technology
Rochester, New York

Abstract:

Computer aided design is emphasized in the Mechanical Engineering Technology Department at Rochester Institute of Technology. The students are using Quattro Pro spreadsheet, TK equation solver, and Algor SUPERSAP finite element software solving mechanical design problems. Some examples are illustrated to show effectiveness of computer applications in mechanical design courses.

Session: IIIA

Integration of Design in Core Engineering

John E. Kolb
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School of Engineering
Rensselaer Polytechnic Institute
Troy, New York

Like many others in the late 1980's, the School of Engineering at Rensselaer Polytechnic Institute responded to national concerns over the quality of engineering education by initiating innovative curricular experiments in the core program. Beyond many others, however, Rensselaer has brought these program changes from pilot to production, and has implemented a new core curriculum for all engineering students entering as freshmen in the fall of 1992. The curriculum redesign effort encompassed every element of the core engineering program at Rensselaer, which is called Pre-engineering.

One of the major components of these changes is the increased design content in engineering education, characterized by instruction in modern design theory and multiple experiential learning projects. This allows students to apply what they know in a creative and rewarding manner.

For example, Introduction to Engineering Design presents design as the integration of creativity, knowledge, skills, and hard work to answer problems. Design is taught under the modern engineering environment of achieving solutions that are high quality, innovative, low cost and timely. The course: presents methods of problem solving which highlight the need for creativity; builds design skills of visualization and calculation; stresses the importance of fully-functional teams to achieve success in design; and presents the importance of collaborating with the customer and manufacturing during design. The course includes a design-build-test experience which requires the integration of electronic, electrical and mechanical systems. This project lets students practice design as a member of a team. The course thus establishes a base for subsequent use of design activities in the curriculum.

This presentation will review the "design curriculum threads" that are woven into the overall curriculum and some details of our experience with the Introduction to Engineering Design course. The overall benefits of design as to how it stimulates the level of challenge, and increases the sense of reward, in an engineering education will be discussed.

Session: IIIA

Prototype Building in Mechanical Engineering Design Courses

Professor Wayne W. Walter
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Rochester Institute of Technology
Rochester, New York

Abstract:

Recently, a faculty team introduced an open-ended design course sequence incorporating real world applications into our mechanical engineering curriculum at RIT. This program consists of a required two-course, senior level capstone design sequence where students are organized in design teams of three or four members. Team members work together on a single design project for two, ten week quarters. Each team selects an open-ended project requiring the team to develop a concept into a working prototype. The projects come from industrial applications, actual needs of agencies, and problems that students obtain from their cooperative work period. At the end of the first course, each team must present their "final" design for evaluation. In the second course, the design is revised as the team actually builds and tests their prototype. All design projects must produce a working prototype which is evaluated by the entire class, faculty and staff, and sponsoring organizations.

The robotics course, a technical elective in the mechanical engineering program, is another non-traditional course whose focus is on an open-ended design project. Here students work in teams of two to design, build and test tooling and fixtures for robots in workcells. Again, the prototype system must be a working one, and is presented to the class, faculty, and staff. The systems usually involve the integration of sensors to detect part presence and proper part orientation. Many of these projects have also come from industry sponsors. The emphasis here is on a hands-on experience that develops self-confidence with robots.

A complete description of the robotics and senior design courses and the development of projects into working prototypes is the focus of this paper. Several case studies are presented.

Implementation of Design in the Mechanical Engineering Program at Ryerson Polytechnic Institute

Judith Dimitriu and M.A. Rosen
Mechanical Engineering Department
Ryerson Polytechnic Institute
Toronto, Ontario

Abstract:

The Mechanical Engineering program at Ryerson Polytechnic University has been accredited since 1992, and offers engineering degrees. In the last year, a general revamping of the mechanical curriculum has occurred, aimed at providing graduates with the knowledge and skills they will require for engineering in the 1990's and beyond. The major thrust of the revised program is to have fewer courses and class hours, more emphasis on individual studies, as well as a major design component integrated into the program. Many others have noted that, while the content of engineering design in engineering curricula has decreased recently in many academic institutions, the need for design skills is growing.

This paper will describe the process of developing a revised curriculum that appropriately blends basic and engineering science components, with strong design studies. The new curriculum will be described, highlighting both the courses that will have increased design components, as well as new courses that will be offered in the senior (fourth) year, and will be devoted to integrated design.

In order to facilitate a more in-depth specialization for the students in a specific field, two fourth-year streams will be offered. One stream will offer four courses in the fields of materials and machine design, while the other stream will offer four courses in the fields of energy and heating, ventilation and air conditioning. Both streams will have a one-year integrated design course that will be team taught, and will cover three or four projects. The above courses will be described in detail in the paper. A summary of the total number of hours and courses for the new program will be given, as well as the design weight in each course.

Rochester Partnership for Math, Science and Technology: Promoting Minority Student Achievement in Science, Mathematics, and Engineering

Mary H. Gilbert
Project Coordinator
Rochester Partnership for Math, Science and Technology
Rochester City School District
Rochester, New York

By using the National Science Foundation's Partnership for Minority Student Achievement as a tool, the Rochester City School District expects to increase the number of minority students entering college mathematics, science and engineering programs by 500% over the next six years.

In 1992, the National Science Foundation announced its new science and mathematics initiatives for minority students. Those initiatives were designed to address well-founded concerns regarding the lack of minority representation in science and math related and engineering career fields. NSF's Partnerships for Minority Student Achievement are a set of grant-funded projects being implemented in four school districts across the country; the Rochester City School District is one of the four districts awarded this grant.

The aim of the NSF-PMSA is solidification of a partnership between the school district, local industry, and higher educational institutions. This partnership is formed with the intent of promoting systemic change within the District and of providing mechanisms for the stimulation of minority student interest and achievement in science and math.

Local partners include:

* Eastman Kodak Company
* Xerox Corporation
* Program for Rochester to Interest Students in Science and Math (PRISSM)
* Rochester Institute of Technology
* The University of Rochester
* SUNY College at Brockport
* Effective Parenting Information for Children (EPIC)

The project is coordinated through the Science and Mathematics Departments of the Rochester City School District.

Session: IIIB

Rochester Engineering Entry Program (REEP)
A Comprehensive Engineering Education Program for Grades 9-12

Paul H. Wojciechowski
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Rochester Institute of Technology
Rochester, New York

The Rochester Engineering Entry Program (REEP) is a comprehensive engineering cirriculum for grades 9-12 located in a Rochester urban high school. The central mission of REEP is to open a path, at the four-year high school level, for predominantly urban and minority students who possess the talent, but need the assistance and resources to successfully pursue post-secondary academic careers in engineering and engineering technology. REEP became operational in September 1993 at Edison Technical and Occupational Education Center with two one-semester dual enrollment (high school/college credit) 12th-grade courses: Materials Engineering in the fall and Computer-based Engineering Analysis in the spring. The full four-year program will be in place and operating by September 1995.

The underlying philosophy of REEP is to integrate, throughout the four-year high school experience, the "Conventional PCB=S" (Physics + Chemistry + Biology + Science) Approach with the "Science, Technology and Society" (STS) Approach organized around (i) real-life issues, (ii) relevance in technical subject matter, and (iii) personal and community decision making.

The primary objective of REEP is to provide high school students with the opportunity to acquire the problem solving skills and proficiencies that characterize engineering work. The primary skills to be emphasized are: mathematical analysis, experimental inquiry, computer simulation, engineering design, effective communication (both written and oral), and the cooperative team skills of accountability and personal responsibility. Plans for the full four-year curriculum will be presented and discussed.

REEP is one component of many that work together to form a "pipeline" of predominantly minority students with strong interest and potential in science and engineering. These program components are supported and coordinated by the Rochester Partnership for Math, Science and Technology (RPMST). The RPMST (see accompanying paper in this session) links together local industry, the city school district, state and federal government, community and professional organizations, and higher education, to provide comprehensive educational and enrichment programs in math, science, and technology in predominantly urban schools.

REEP is supported in part by a grant from the New York State Education Department STEP Program, by the Rochester City School District, and by several RPMST partners.

Session: IIIB

On the Development of First Year Engineering Design Experiences

Professor Barry L. Wills
Systems Design Engineering
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Abstract:

In the first year of their studies, engineering students need to have a clear and comprehensive introduction to the profession. Ideally this should include a brief history of engineering, a summary of engineering job opportunities, an overview of the undergraduate curriculum, and in particular, an introduction to design methods, including creative problem-solving and design-team dynamics. Many of the fundamental ideas can be presented in lectures and readings but the material on design needs to be augmented by a set of design experiences where students, working in small teams, create and implement solutions to carefully chosen problems.

Devising and running appropriate design experiences for first year students can be very challenging but, if done carefully, valuable for the students and rewarding for the instructor(s). It is impossible, of course, to provide an algorithm for producing successful design experiences. This paper, however, provides a set of criteria and operating guidelines which have worked well for the author. Some of them may therefore be helpful to others and may provide a framework for instructors to develop their own design experience methods.

In order to illustrate how the author's criteria and guidelines are used, specific examples are discussed which include a description of the design challenges given to the student, the organization and scheduling details, and the schemes used for evaluation of each team's performance.

Session: IIIB

The Evolving Engineering Design Curriculum at Alfred University

Joseph W. Rosiczkowski
Assistant Professor
Mechanical Engineering Department
Alfred University
Alfred, New York

Abstract:

Design experiences have, until recently, been thought of as the sole province of the senior engineering student on the threshold of graduation and entering the "real world" of engineering. These capstone design experiences were meant to provide opportunities for the student's capacity for creative and imaginative thought to be utilized in generating and evaluating solutions to engineering problems.

The question had to be asked as to why not introduce design experiences earlier into the engineering education process? Why focus on the later year(s) of the engineering education process and neglect the early years? Why not introduce a design experience for incoming engineering students that demonstrates the engineering profession is one that enhances individual creativity and imagination? It is the circumstances that prompted these questions to be asked and the answers to them that will be presented. The design curriculum at Alfred University has evolved from being primarily focused on the outgoing engineering student to one which additionally addresses the incoming engineering student to one that now attempts to integrate useful and rewarding design experiences throughout the full term of the engineering education process.

Session: IIIB

Undergraduate Academic Advising Initiatives

Richard Reeve
Associate Dean
College of Engineering
Rochester Institute of Technology
Rochester, New York

Dr. Richard Reeve will overview new facets of the undergraduate advising program within the College of Engineering including an Advisor Training Workshop for faculty and the use of the College Student Inventory instrument.

The College of Engineering is running a pilot program utilizing the College Student Inventory instrument. Freshman studies in Electrical, Mechanical, Industrial and Manufacturing, Computer, and Microelectronics Engineering are utilizing the instrument studies in the Fall of 1993. It is anticipated that the instrument will assist in:

1. effectively initiating contact with students.

2. establishing rapport with students.

3. identifying at risk students.

4. identifying action items for both the student and advisor.

Dr. Reeve will address why the instrument was selected, what the instrument's objectives are, and RIT's initial experience with the advising tool.

The Role of Solid Modelling in Engineering Graphics

Don Bunk
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Rensselaer Polytechnic Institute
Troy, New York

The advent of CAD software which allows the creation of volumetric objects and documentation of the same affects the traditional engineering graphics pedagogy.

Documentation of designs via the orthographic views, which characterize engineering drawings, now become a by-product of the solid model, which also provides the framework for stress and deformation analysis using ancillary finite-element software.

The basis for creating solids are almost always centered around the concept of volume of revolution and the process of extrusion. This dictates that the visualization process is now embedded in the understanding and development of right cross-sections to create a base feature. Boolean operations in one form or another allow the modification of volumes to create the actual piece part design.

Sub-assembly and assembly of piece parts stored in the database allow for evaluating the design and making adjustments. This is particularly the advantage of parametric modelling software.

As a final step in utilizing the solid model for the documentation and communication to the shop the engineering drawing is created. This drawing is a traditional orthographic viewing of the piece part in assembly. Views are arrived at by manipulation of a pictorial view placed in a format in the drawing mode of the software program.

At Rensselaer students entering the school of engineering are required to take a course in modelling and documentation in their first year as a prelude to a first course in conceptual design given in the second year.

This paper will discuss the role of visualization in the creating and documenting solid models, the integration of dimensioning practices between the model creation and its documentation, and the effect of modelling on assembly drawings and sectioning practices.

Session: IIIC

Mechanical and Electrical Design Workshops
Moderator: W. David Baker
School of Engineering Technology
Rochester Institute of Technology
Rochester, New York

1. Solid Modeling on Unigraphics
   Presenter: S.M. Ramkumar

The participants in the workshop will use the UNIGRAPHICS CAD system to design a product using Solid Modeling techniques. This hands-on exercise will take about one and a half hours to complete. The step by step procedure to complete the exercise will be provided and it will be very easy to follow. No prerequisites in CAD are required.

2. Electronic Design Automation Using Analog Work Bench
   Presenter: George Zion

The power and capabilities of the Analog Work Bench, an industry used Electronic Design Automation tool from Cadence Logic Systems, will be demonstrated.

In addition to the traditional analysis capabilities common to most EDA tools, ie D.C., A.C. and frequency domain analysis, the Analog Work Bench also has several advanced analysis tools. The parametric entry & plotter tools permit the circuits performance to be analyzed when component and/or semiconductor parameters are varied. The smoke alarm tool allows the circuit's power dissipation sensitivity to component tolerances to be determined.

The above mentioned analysis techniques will be demonstrated by critiquing a multi-stage active filter design. In addition, several student design projects will also be discussed.