ASEE SOUTHEASTERN SECTION ANNUAL CONFERENCE

APRIL 6 - 8, 2008

"*Building Bridges: Making the Connections that Facilitate Engineering Education*"

UNIVERSITY OF MEMPHIS
MEMPHIS, TENNESSEE

Proceedings Editor:	Barbara Bernal Southern Polytechnic State University
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Conference Program Chair:	Paul Palazolo University of Memphis

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THE UNIVERSITY OF
MEMPHIS.

April 6, 2008

Dear Conference Attendees:

On behalf of the Herff College of Engineering and the entire University of Memphis, welcome to the 2008 southeast regional conference of ASEE. I hope you enjoy your visit to our campus and to the City of Memphis. We are delighted to be your hosts this year, and we hope that your stay is both enjoyable and productive.

This year, the conference focus will be on building bridges between the communities that we interact with. This includes the K-12 community, the student community, the professional community and the academic community. During this week, you will be able to hear outstanding presentations and discussions about the interactions that we, as engineering educators, have with each of these communities.

Our kick-off speaker on Monday morning will be Mr. Jim Phillips. Jim has served on our college Advisory Board for many years and has an exceptional understanding of the connection between our work as engineers and the entrepreneurial spirit that drives innovation. We are also privileged to have Dr. Sarah Rajala, the president-elect of ASEE, as the keynote speaker. Dr. Rajala will detail for all of us how ASEE facilitates our abilities to build all the bridges we need to be more effective engineering educators. In addition to the faculty and staff attendees, I'm especially pleased to welcome all the students who will travel to the conference to participate in the Student Poster competition. It is inspiring to see your excellent work on display.

Enjoy your stay in Memphis and the conference. Hopefully our southern hospitality and a large plate of ribs will make this a memorable conference for you.

Richard C. Warder, Jr., PE
Dean of Engineering
Professor of Mechanical Engineering

American Society for Engineering Education

Cecelia Wigal, President
Southeastern Section

Instruction ♦ Administration ♦ Research

Welcome to the 2008 ASEE Southeastern Section (SE) Annual Conference. This year's focus on "*Building Bridges: Making the Connections that Facilitate Engineering Education*" emphasizes ASEE's and the SE section's awareness of how engineering education can benefit from connecting with the environment around us. The Keynote address by Mr. Jim Phillips, Managing Director, Pinnacle Investments, will jump start our conference and the discussion of these connections. Dr. Sarah A Rajala, our Awards Banquet speaker and ASEE President-Elect will give fuel to our thinking more about these connections. The workshop on Sunday on GIS in engineering education addresses another connection that may interest many of you.

I want to express my sincere thanks to the Site Committee at the University of Memphis for hosting this conference. I understand what it takes to pull an event such as this together and I greatly appreciate the time and effort they have dedicated to making it a success. I also want to thank all of the officers and members of the Section who have worked on the conference technical program. The conference could not be a success without those of you who planned the design of the technical program, participated in the peer-review of the manuscripts, coordinated the workshop, organized the student poster session, prepared the conference Book of Abstracts and CD-ROM, reviewed award nominations, and volunteered to moderate technical sessions. You played a major role in providing a conference that offers something useful for anyone interested in engineering education.

I also want to express a special welcome to the undergraduate and graduate students who are participating in the conference technical sessions and/or poster session. Thank you for your important contribution to the conference.

I look forward to this conference every year because I learn so much from you, my ASEE SE Section colleagues. The variety of ideas you bring to share at this conference help me to improve what I do in and out of the classroom. I hope you recognize, that as you share what you have researched, learned, and experienced, you are building bridges and making those connections that facilitate the education of our present and future students, ourselves, and those who follow us. This meeting would not be the same without your participation.

I hope you have a very enjoyable and meaningful time at the conference and in Memphis. I look forward to meeting you as we discuss building our bridges.

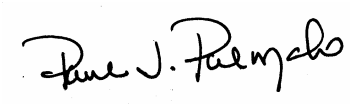
Cecelia M. Wigal, Ph.D., P.E.
The University of Tennessee at Chattanooga
ASEE SE President

Acknowledgements…

As conference chair 1 would like to thank everyone that had a hand in the organization and preparation for the 2008 ASEE Southeastern Section Conference. A special thanks to:

- the 109 registered conference attendees from 60 universities
- the 25 student teams in the poster competition
- the 107 presenters in the technical sessions
- Courtney A. Minzenmayer, Conference Coordinator, Conference Planning & Operations, The University of Memphis for pulling this all together
- Mr. Jim Phillips (keynote speaker) and Dr. Sarah Rajala (awards banquet address)
- Dean Richard Warder for his welcome address and support from Herff College of Engineering
- the staff at the Holiday Inn and the Fogelman Executive Center
- Cecelia Wigal, Don Visco, Barbara Bernal and the members of the Executive Board for their guidance in the planning
- the University of Louisville and all the previous hosts for warning us of what was coming and helping us over most of the rough (and our best wishes to Southern Polytechnic State University for next year)
- Amy de Jongh Curry, Brian Waldron, Gary Qi, Peter Lau, Richard Pasley, Stephanie Ivey, and Thomas Banning who were the working committee from the Herff College and who did far more than was asked of them
- Carolyn Oldenberg who worked so hard with sponsors for the event
- Katherine Garrott who designed the cover for this program
- Thomas Dion and Ken Brannon for reminding me of details that I would never have remembered
- ThyssenKrupp Elevator Manufacturing Corporation, Cargill, ASCE West Tennessee Branch, IEEE Memphis Section, NSBE Alumni Extension Memphis Chapter, and Memphis Joint Engineers Council for their help and financial support
- all of you for your patience and understanding as I ran in circles

If you need any help during the conference, please go to the second floor of the Fogelman Executive Center – conference staff should be around to answer your questions or provide assistance. Enjoy the conference and your time in Memphis.



Paul J. Palazolo
Conference Chair

ASEE SE 2008 Conference Overview

Sunday, April 6, 2008

11:00am – 7:00pm	Conference Registration	Holiday Inn Hotel
1:00pm – 3:00pm	Workshop: GIS in Eng. Ed.	Herff COE (EA102C)
2:00pm – 3:00 pm	Tour of FedEx Institute	FedEx Institute of Technology
3:00pm – 5:00pm	Executive Board Meeting	Dean's Conference Room
6:00pm – 8:00pm	Welcome Reception	Big Foot Lodge

Monday, April 7, 2008

7:30am – 8:30am	Conference Registration	Holiday Inn Hotel
7:30am – 8:30am	Breakfast & Unit Meetings	FEC Dining Room
8:45am – 10:00am	Welcome & Keynote Address	FEC Room 136
10:00am – 10:30am	Morning Break	FEC Foyer
10:00am – 12:00pm	Student Poster Session	Lower Atrium
10:30am – 12:00pm	Technical Session 1	FEC Rooms
12:00pm – 1:30pm	Lunch and Presentation	HI Shelby Ballroom
1:45pm – 3:15pm	Technical Session 2	FEC Rooms
3:15pm – 3:45pm	Afternoon Break	FEC Foyer
3:45pm – 5:30pm	Technical Session 3	FEC Rooms
6:00pm – 9:00pm	Reception and Award Banquet	HI Shelby Ballroom

Tuesday, April 8, 2008

7:30am – 8:30am	Breakfast & Division Meetings	FEC Dining Room
8:45am – 10:15am	Technical Session 4	FEC Rooms
10:15am – 10:30am	Break	FEC Foyer
10:30am – 12:00pm	Technical Session 5	FEC Rooms
12:00pm – 1:30pm	Lunch & Business Meeting	FEC Back Dining Room
1:30pm	Conference Adjourn	

Note: Map of Fogelman Executive Center Meeting Rooms and Holiday Inn on page 1.9

ASEE SE 2008 Annual Conference Schedule

Sunday, April 6, 2008

10:00 – 7:00 pm	**Conference Registration** Holiday Inn Hotel – University of Memphis
1:00 – 3:00 pm	**Workshop** **Herff College of Engineering (Room EA102C)** *"GIS in Engineering Education"*
2:00 – 3:00 pm	**Tour** **FedEx Institute of Technology**
3:00 – 5:00 pm	**Executive Board Meeting** **Herff College of Engineering (Dean's Conference Room)**
6:00 – 8:00 pm	**Welcome Reception** **Big Foot Lodge** **97 S 2nd Street** **901.578.9800**

ASEE SE 2008 Annual Conference Schedule

Monday, April 7, 2008

7:30 – 8:30 am	**Breakfast and Unit Meetings FEC Dining Room**				
8:45 – 10:00 am	**Moderator: Cecelia Wigal, President ASEE SE Section Welcome: Richard Warder, Dean, Herff College of Engineering Keynote Address: Mr. Jim Phillips, Managing Director, Pinnacle Investments FEC Room 136**				
10:00 – 10:30 am	**Morning Break FEC Foyer**				
10:30 – 12:00 am Technical Session 1	**T1-A FEC 308**	**T1-B FEC 215**	**T1-C FEC 219**	**T1-D FEC 123**	**Lower Atrium**
	Chemical and Civil Eng. 1 *Course Improvement Strategies*	**Computer Engineering**	**Civil Engineering 1** *Student Engagement: P-16*	**Administrative Division 1** *Integration and Interdisciplinary Activities*	**Student Poster Session** **Closed Session Set up and Judging**
12:00 – 1:30 pm	**Conference Luncheon: Thomas Evans Outstanding Instructional Paper, HI Shelby Ballroom**				
1:45 – 3:30 pm Technical Session 2	**T2-A FEC 308**	**T2-B FEC 215**	**T2-C FEC 219**	**T2-D FEC 123**	**Lower Atrium**
	Engineering Technology 1 *Student Engagement*	**Instructional Division 1** *Technology in and out of the Classroom*	**Administrative Division 2** *Issues Concerning Underrepresented Groups*	**Administrative Division 3** *Assessment and Analysis*	**Student Poster Session** **Open Session to the Public**
3:30 – 3:45 pm	**Afternoon Break FEC Foyer**				
3:45 – 5:30 pm Technical Session 3	**T3-A FEC 308**	**T3-B FEC 215**	**T3-C FEC 219**	**T3-D FEC 123**	**T3-E FEC 218**
	Engineering Technology 2	**Research Division**	**Civil Engineering 2**	**Administrative Division 4** *Retention and Outreach*	**Engineering Technology 3**
6:00 – 9:00 pm	**Reception (6:00) and Awards Banquet (6:30) Sarah A. Rajala James Worth Bagley Chair, Mississippi State University and ASEE President-Elect HI Shelby Ballroom**				

Note: **Where applicable, themes for a particular session have been listed in** *italics.*

ASEE SE 2008 Annual Conference Schedule

TUESDAY, April 8, 2008

7:30 – 8:30 am	**Breakfast and Division Meetings** **FEC Dining Room**				
8:45 – 10:00 am **Technical Session 4**	**T4-A** **FEC 308**	**T4-B** **FEC 215**	**T4-C** **FEC 219**	**T4-D** **FEC 123**	**T4-E** **FEC 218**
	Chemical Engineering 2 *Interdisciplinary Activities*	**Mechanical Engineering 1** *Materials and Design*	**Professional Skills**	**Administrative Division 5**	**Software Engineering**
10:00 – 10:15 am	**Morning Break** **FEC Foyer**				
10:15 – 12:00 pm **Technical Session 5**	**T5-A** **FEC 308**	**T5-B** **FEC 215**	**T5-C** **FEC 219**	**T5-D** **FEC 123**	**T5-E** **FEC 218**
	Civil and Electrical Eng.	**Mechanical Engineering 2**	**Civil Engineering 3** *Curricular Issues*	**Administrative Division 6**	**Management Issues and Ind. Eng.**
12:00 – 1:30 pm	**Section Annual Business Luncheon** **FEC Back Dining Room**				
1:30 pm	**Conference Adjourn**				

Conference Parking and Transportation

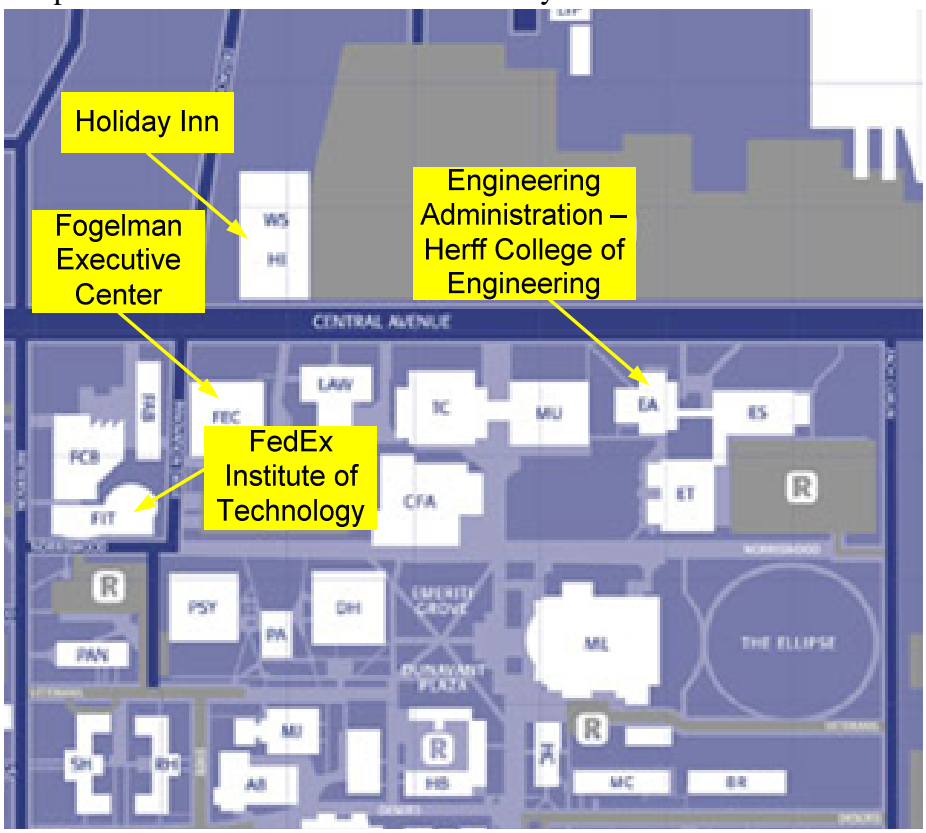
The 2008 ASEE-SE Conference is being held on the campus of the University of Memphis. Technical sessions will be held in the Fogelman Executive Center on the campus directly across from the Holiday Inn. The Sunday night reception will be held at the Big Foot Lodge in downtown Memphis. A bus will be available to take attendees from the Holiday Inn to the Sunday night reception leaving at 5:30 pm and returning from downtown at 8:00 pm.

Parking at the Holiday Inn

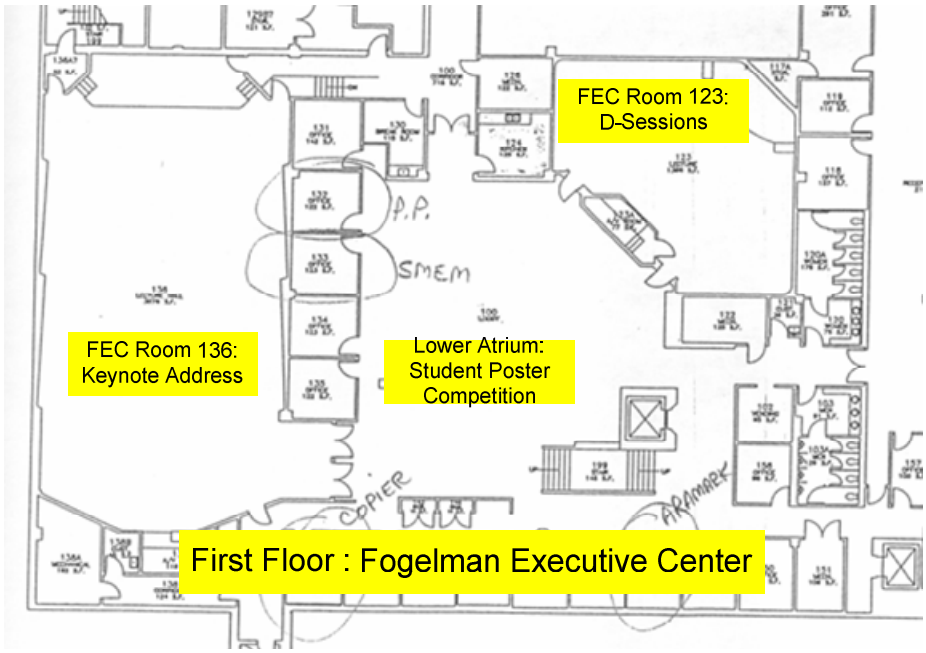
Free parking is available adjacent to the Holiday Inn.

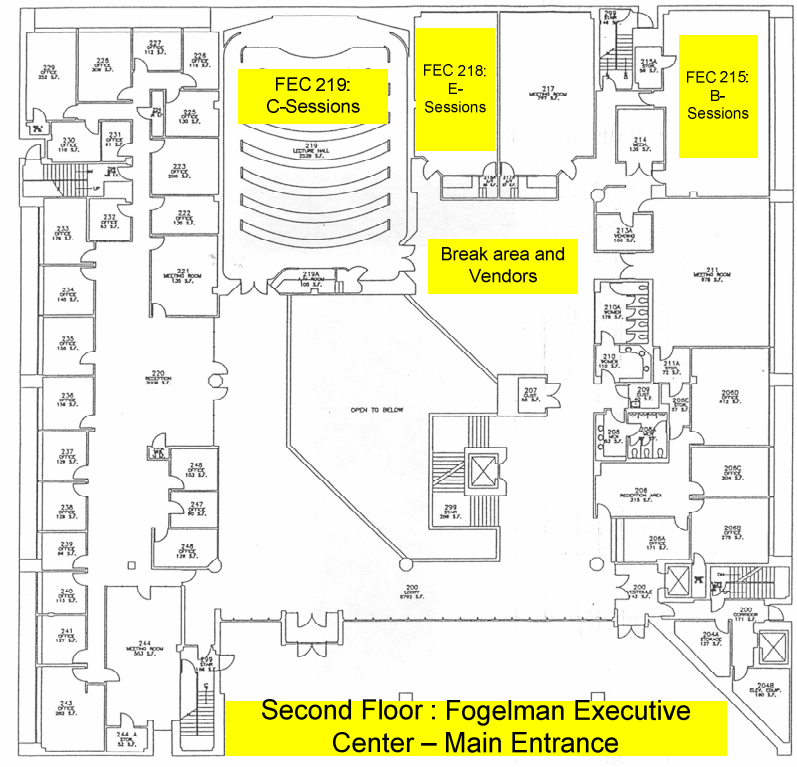
Map of Conference Meeting Rooms

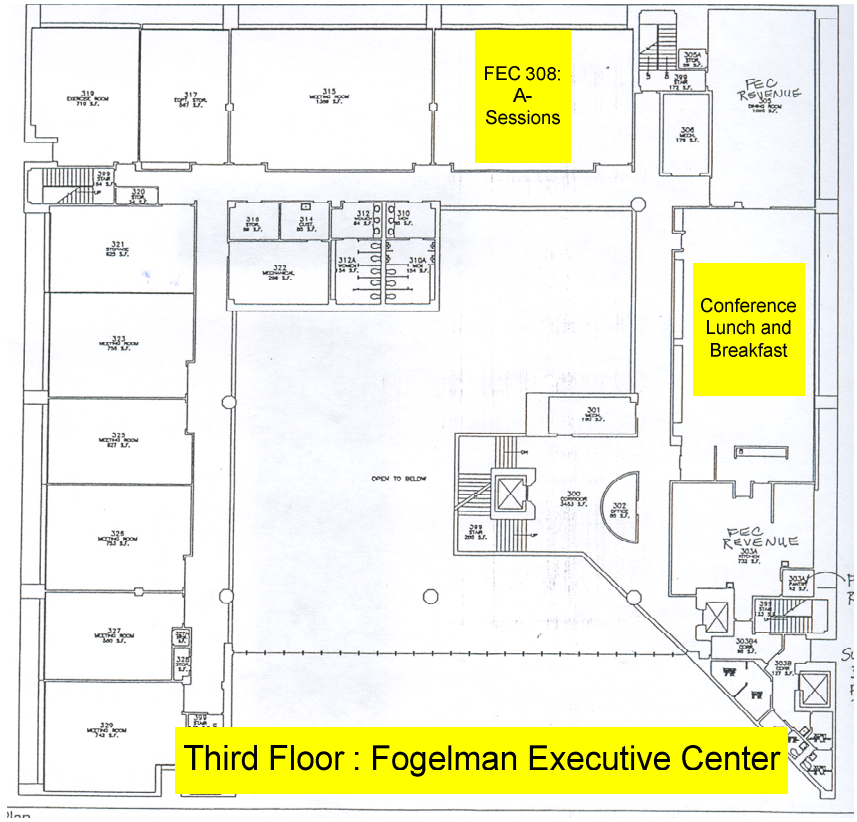
All meetings and meals will be in the Fogelman Executive Center with the exception of the Sunday welcome which will take place at the Big Foot Lodge, and the Awards Banquet and reception which will be held in the Holiday Inn.

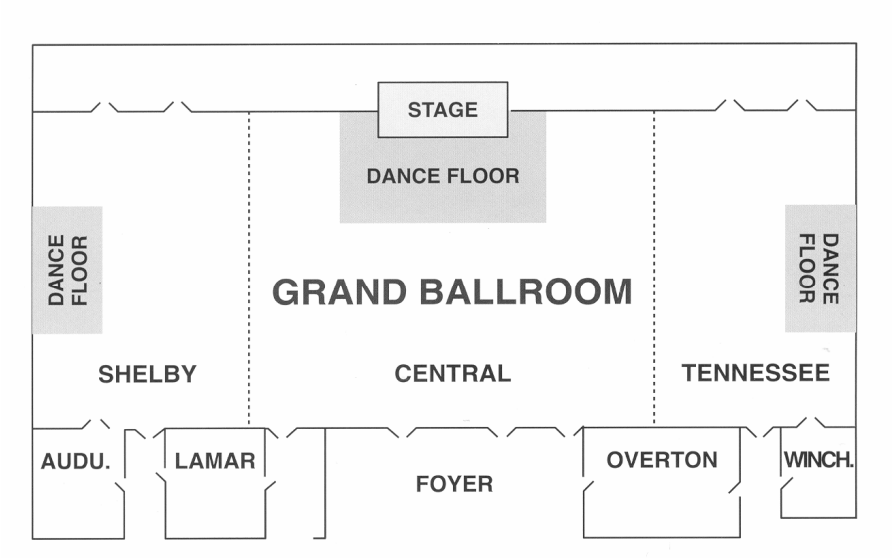


University of Memphis Campus Map (also available in more detail at map.memphis.edu)




FEC 219: C-Sessions
FEC 218: E-Sessions
FEC 215: B-Sessions
Break area and Vendors
Second Floor : Fogelman Executive Center – Main Entrance


FEC 308: A-Sessions
Conference Lunch and Breakfast
Third Floor : Fogelman Executive Center

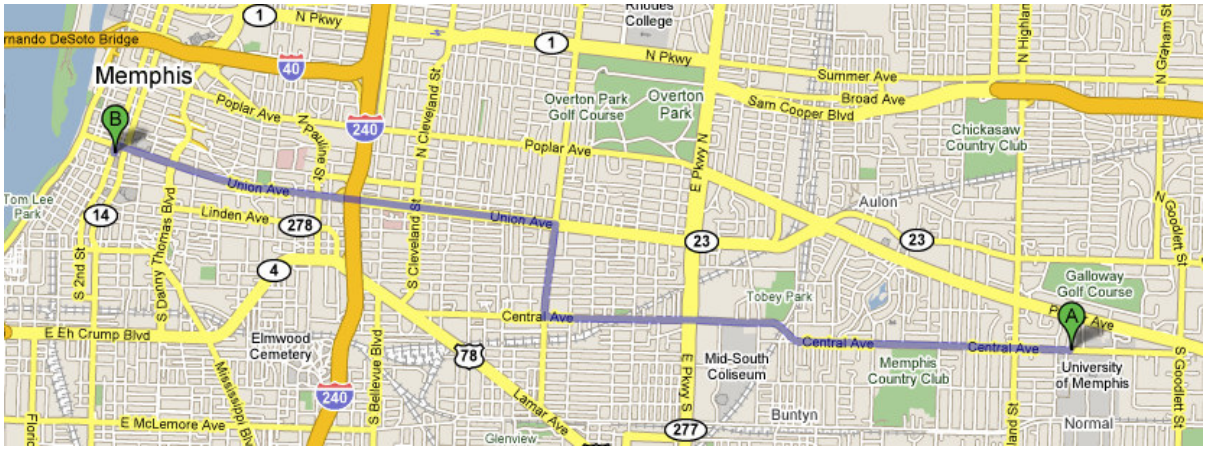


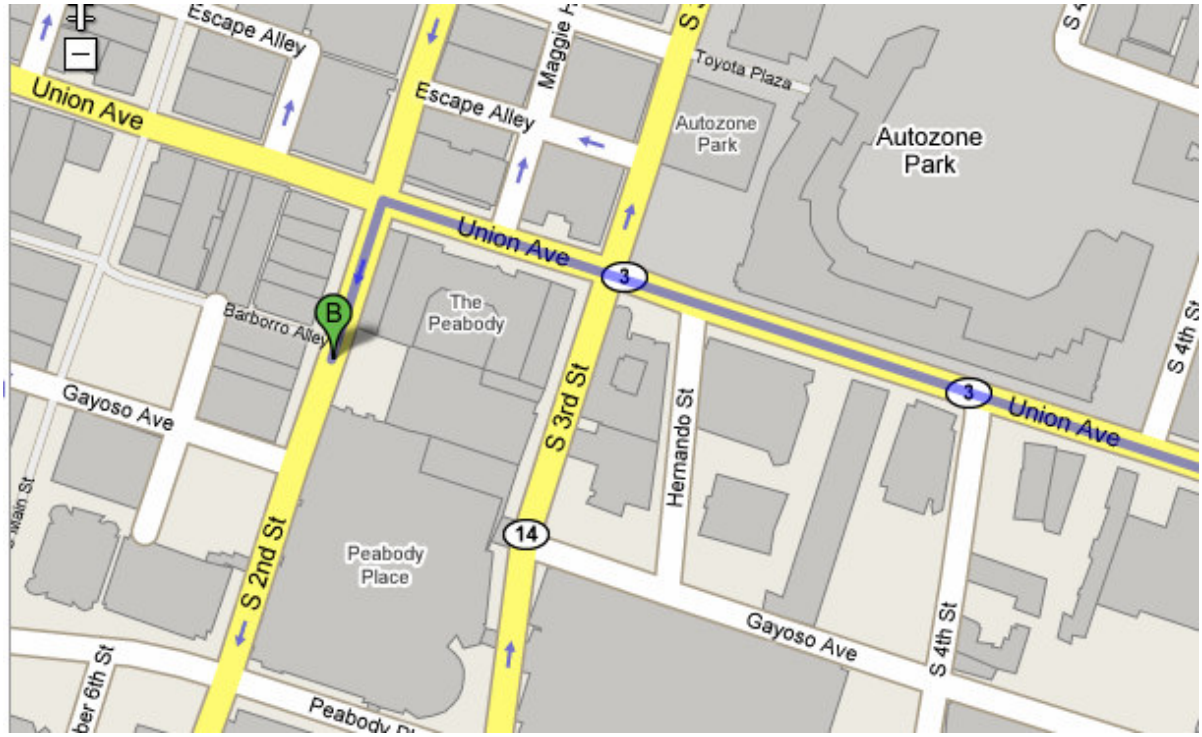
Awards banquet will be in the Shelby Ballroom on the third floor of the Holiday Inn

Map to Sunday Night Reception – Big Foot Lodge

The Sunday night reception (6:00 – 8:00 pm) will be held at the Big Foot Lodge in downtown Memphis near Beale Street.

Driving directions:
The Big Foot Lodge is located approximately 8 miles from the Holiday Inn. Driving instructions are shown below. Parking can be an adventure in downtown but there usually is available parking on Sunday evening. The Big Foot Lodge is within walking distance of Beale Street. 2nd street, where the Big Foot Lodge is located, is a one-way street headed south.





Bus:
There will be a bus from the Holiday Inn to the reception leaving from the hotel at 5:30 pm and returning directly after the reception. If you wish to stay in downtown Memphis later than the reception, no transportation will be provided by the conference. This may be a problem because there is limited cab service in Memphis and almost no public transportation from downtown to the University of Memphis campus on Sunday night.

Conference Meals and Receptions

Welcome Reception: Sunday, April 6th 6:00pm – 8:00pm

The Big Foot Lodge
97 S 2nd Street
901.578.9800

Unit Meetings Breakfast: Monday, April 7th (7:30am – 8:30am)

Room 304, Fogelman Executive Center

A full breakfast buffet will be served starting at 7:30. Join the conference attendees for the Unit meetings breakfast. Sit down at one of the table clusters and meet colleagues with interests in the following ASEE-SE areas:

- Programs
- Publications and Promotions
- Awards and Recognition

There are many ways to be involved and contribute to ASEE SE!

Thomas Evans Award Luncheon: Monday, April 7th (12:00 – 1:30pm)

Room 304, Fogelman Executive Center

The Thomas Evans Outstanding Instructional Paper will be presented at Monday's lunch.

Awards Banquet: Monday, April 7th (6:00 – 9:00pm)

Shelby Ballroom, Holiday Inn

Come celebrate engineering education and the role of the ASEE-SE and its members. Many people will be congratulated on their outstanding contributions to the field of engineering education. Entertainment will be provided by a jazz trio from the university.

Division Meetings Breakfast: Tuesday, April 8th (7:30 – 8:30am)

Room 304, Fogelman Executive Center (*FEC Dining Room and Back Dining Room)*

Grab your breakfast from the wonderful buffet and join the conference attendees for the Division meetings:

- Administrative
- Bioengineering
- Chemical Engineering
- Civil Engineering
- Computer Engineering & Technology
- Electrical Engineering
- Engineering Design Graphics
- Engineering Technology
- Industrial Engineering
- Instructional
- Mechanical Engineering
- Professional Skills
- Research
- Software Engineering

Section Business Meeting Lunch: Tuesday, April 8th (12:00 – 1:30pm)

Room 304, Fogelman Executive Center

Please come to the ASEE SE Business meeting to meet your present Section Officers and vote for your Section Officers for the upcoming year. We will also recap the events of the conference and officially announce the location for the 2008 Conference.

Conference Workshops

Workshop 1: Sunday, April 6th, 1:00 – 3:00 pm
Room EA102C – Herff College of Engineering

GIS in Engineering Education

Zachary Layne, P.E.
ESRI Account Executive

The rapid pace of technology change creates a challenging environment for engineering educators. The presentation will provide an overview of GIS technology used by engineers at government agencies and consulting firms. Attendees will get ideas for integrating GIS into existing courses and programs. The presentation will be focused on Civil and Environmental Engineering applications.

Presenter Bio:
Mr. Layne is a 1994 graduate of the University of Kentucky College of Engineering and has been with ESRI since 2004. Prior to joining ESRI, Mr. Layne worked for a full-service Architectural-Engineering firm based in Nashville, Tennessee. Mr. Layne also has 3 years of experience working in Kentucky State Government within the Kentucky Transportation Cabinet and the Kentucky Department for Environmental Protection.

Workshop 2: Sunday, April 6, 2:00 – 3:00 PM

FedEx Institute of Technology Tour
FIT Staff

A tour through the FedEx Institute of Technology.

The FedEx Institute of Technology is where science, business and industry intersect at the University of Memphis for advanced research. A versatile, high-tech facility, the Institute is ideal for think tank sessions, corporate retreats, training and national conferences.
The FedEx Institute is home to cutting-edge research teams working in areas such as artificial intelligence, biotechnology, geospatial analysis, multimedia arts and nanotechnology. It also serves as a gateway for businesses to collaborate with University of Memphis researchers. In all, the Institute is home to over 150 faculty members, researchers and staff.
The FedEx Institute of Technology is changing the face of healthcare, education, entertainment, business, government and the arts, inspiring new thinking in the industries it touches.

Keynote Speaker

James M. Phillips
Managing Director, Pinnacle Investments

Jim Phillips holds BBA and MBA degrees from the University of Memphis, graduating with academic honors. He was formerly Vice President of Notel Networks; President & Co-Founder of SkyTel – the nation's largest messaging company; President & Vice Chairman of Telular Corp.; Corporate Vice President and General Manager of Motorola, PCS and Multimedia divisions, where his team invented the cable modem. He was instrumental in the development of the wireless local loop cellular voice and data telephone, alarm and telemetry systems.

Jim also Co-Founded iPIX Corporation where he served as Chairman and CEO. During his tenure with iPIX, he led the company to become what Forbes called "the Kodak of the Internet." The company revolutionized imaging across the internet, inventing virtual tours that are a staple on real estate, hotel & entertainment websites and the only 360x360 security camera system used by the White House and many government agencies and corporations. In addition, through the acquisition of Bamboo.com and Picture Works, Jim oversaw the development of the popular image submission process utilized by millions of e-Bay users everyday. He also holds patents in cell phones, PDA and data modem design.

While furthering his management career, Jim served as CEO in residence and special advisor to the Private Equity Groups at Morgan Keegan & Co. As Founding Chairman and Executive Director of the FedEx Institute of Technology (FIT), he helped establish this leading research park on the campus at the University of Memphis. Information Week called FIT "the technology industry's newest center for innovation" and WIRED Magazine compared it to Media Lab and MIT. Jim also founded and served as Chairman and CEO of Snowflake Corporation – a leader in biometric identification.

In 2004, Jim was named one of Information Week's Innovators of the Year. That same year, he became Chairman and CEO of Luminetx Corporation and led the development and commercialization of a breakthrough medical device called the "VeinViewer" Time Magazine named this milestone the "coolest medical invention of year" and Red Herring Magazine featured Luminetx Corporation at the top of the list of North America's 100 Best Technology Startups in 2006.

Among his many honors and awards, Jim was named Tennessee Businessman of the Year in 1999 by the U.S. Small Business Administration. In 2006, he was inducted into the Memphis Entrepreneurial Society. His innovative contributions and business leadership have been chronicled in many national publications including: Forbes, Fortune, Business Week, The Standard, The New York Times, The Wall Street Journal and USA Today. He has made numerous appearances on Fox News, CNN, CNNfn, CNBC, the BBC and CBS Morning News.

Banquet Address

Sarah A. Rajala

Professor and Department Head
James Worth Bagley Endowed Chair
ASEE President Elect

Sarah A. Rajala is currently professor and department head of electrical and computer engineering at Mississippi State University. She also holds the James Worth Bagley Endowed Chair. Prior to coming to Mississippi State University in December 2006, she served as associate dean for research and graduate programs in the College of Engineering at North Carolina State University. She joined the faculty at NC State in 1979 and has served as director of the Industry/University Cooperative Research Center for Advanced Computing and Communication from 1993-1996, associate dean for academic affairs from 1996-2002 and in her current role since 2002. From 1987-1998, she held a visiting appointment in the School of Electrical Engineering at Purdue University. Her research expertise is in the areas of engineering education and the analysis and process of images and image sequences with application to the areas of color imaging, image coding/compression, motion estimation, and target acquisition and tracking. During her career she has directed 17 master's theses and 16 Ph.D. dissertations. She has authored and co-authored over 100 papers in these areas and has had contributions published in thirteen books.

Rajala has received numerous awards for her research and professional contributions, including the Presidential Award for Excellence in Science, Mathematics and Engineering Mentoring in 2000, Fellow of the Institute of Electrical and Electronic Engineers (IEEE) in 2001, and Fellow of the American Society for Engineering Education (ASEE) in 2007. She has an extensive record of leadership to professional and volunteer organizations including the ASEE, IEEE, Phi Kappa Phi, and Sigma Xi. She is the president-elect of ASEE, represents the ASEE as a member of the ABET Engineering Accreditation Commission, and is member of the ASEE Accreditation Activities Committee and the IEEE Committee on Engineering Accreditation Activities.

She received her B.S. degree in electrical engineering from Michigan Technological University in 1974, and the M.S. and Ph.D. degrees in electrical engineering from Rice University, in 1977 and 1979, respectively. She has been recognized by Michigan Technological University as the 1986 Outstanding Young Alumni and elected to the Council of Alumnae and Academy of Outstanding Electrical Engineers in 1996.

ASEE Southeastern Section Officers

Members of Executive Board

President.....Cecelia Wigal
President-Elect .....Barbara Bernal
Immediate Past President.....Shelton Houston
Vice-President (Programs Unit).....Keith Plemmons
Vice-President (Awards & Recognition Unit).....Claire McCullough
Vice-President (Publications & Promotions Unit).....Brent Jenkins
Secretary/Treasurer .....Tulio Sulbaran

Other Officers

Newsletter Editor/Webmaster.....Ken Brannan
Proceedings Editor .....Barbara Bernal
Campus Representative Coordinator .....Thomas Dion

Unit and Division Officers

Unit	Chair	Vice-Chair	Secretary
Programs	Keith Plemmons	Donald Visco	Brent Jenkins
Awards & Recognition	Claire McCullough	Alice Scales	Paul Palazolo
Publications & Promotions	Brent Jenkins	Scott Schultz	Priscilla Hill

Division	Chair	Vice-Chair	Secretary
Administrative	Richard Mines	Tim Wilson	Scott Yost
Bioengineering	*vacant*	*vacant*	*vacant*
Chemical Engineering	Venkat Subramanian	David Silverstein	Adrienne Minerick
Civil Engineering	Shane Palmquist	John Murden	Stephanie Ivey
Computer Engr & Tech	Tyson Hall	Daniel Kohn	Tom Banning
Electrical Engineering	Zhaoxian Zhou	*vacant*	Tim Pratt
Engr Design Graphics	Ted Branoff	Aaron Clark	Michael Woo
Engineering Technology	Ken Hutnick	Salame Amr	Jerry Newman
Industrial Engineering	David Elizandro	Scott Schultz	Cecelia Wigal
Instructional	Hodge Jenkins	Ted Branoff	Tyson Hall
Mechanical Engineering	Loren Sumner	Mary Emplaincourt	Davyda Hammon
Professional Skills	Peter Romine	Ed Hajduk	Peter Hoadley
Research	Tim Mays	Sally Pardue	Ed Hajduk
Software Engineering	Juan C. Guzman	Rey Seyfarth	Andrew Stelzoft

Technical Session Information

Session and Presentation Timing

Each technical session is scheduled for 4-6 presentations. Some technical sessions have sections with a non-uniform number of papers. This is a result of late cancellations and attempting to theme sessions. In order to facilitate movement between sections in a technical section, each paper in a given technical section will be allotted the same amount of time. The presentation start times are listed in the grid below. This includes the introduction time and a 2 minute question/answer period. If there is a no-show author in a session, a break will be called. **Papers should not be moved up or rearranged in sessions.**

	Session 1	**Session 2**	**Session 3**	**Session 4**	**Session 5**
Presentation #1	10:30	1:45	3:45	8:45	10:15
Presentation #2	10:48	2:02	4:06	9:03	10:36
Presentation #3	11:06	2:19	4:27	9:21	10:57
Presentation #4	11:24	2:36	4:48	9:39	11:18
Presentation #5	11:42	2:53	5:09	---	11:39
Presentation #6	---	3:10	---	---	---

Technology Available to Presenters

Each presentation room is equipped with a projector, a laptop PC with USB port, and a wireless internet connection. Software common to each presentation room is the basic Microsoft Office package that includes Microsoft PowerPoint. We suggest that you load your presentations to the PC in your conference room before your presentation. If you must use your own laptop, let us know at registration and test it out with our projectors.

Instructions for Technical Session Moderator Chairs

Be prepared to moderate the session.
Arrive 10 minutes early to the room where the session you are moderating is being held. Meet the presenters as they enter the room and go over the pronunciation of their name. Make sure all presentations are loaded and ready to go *before* the session starts. Bring a watch.

Provide presentation guidelines at the beginning of the session.
Introduce yourself at the beginning of the session. Remind presenters of the time limitations and that you will give a hand signal to warn that there are 5 minutes and then 2 minutes remaining.

Introduce each presenter or presenters prior to their presentation.
At the end of each presentation, the next speaker should come up and ready their slide show. Introduce the presenter when ready.

Maintain the presentation schedule.
One primary responsibility of the moderator is to ensure that the presenters begin and finish their presentations on time according to the technical program. Maintaining the presentation schedule within the session allocated time helps to have fair treatment for all presenters. In the event that a presenter, who is not last in the hour, is not present or has canceled, please wait to begin the next paper at the scheduled time, so that all who planned to attend the remaining paper(s) can. The moderator has the authority to stop a presentation that is about to run overtime in a respectful manner. It is also the job of the presenter to prepare to fit the presentation in the allotted time. Try your level best to not let a presentation and Q&A overrun the allotted time.

Student Poster Session Information

The Research Division is offering the 3rd annual Student Poster Competition, immediately after the Monday morning keynote address. The posters will be located in the Lower Atrium. Students may set up their posters immediately following the keynote address with judging taking place shortly from 10:30-12:00. The poster exhibits will be open to the public from 1:45-3:30. Awards and certificates will be presented during the Monday evening awards banquet for the following categories:

- Freshman/Sophomore Engineering and/or Engineering Technology Design Teams
- Junior/Senior Engineering and/or Engineering Technology Design Teams
- Undergraduate Research

The Student Poster Competition gives undergraduate students the opportunity to (1) share their research/project work with students and faculty from other institutions and (2) practice their visual, written, and oral communication skills in a professional/conference environment. The goals of the competition are to (1) improve the visibility of student efforts, (2) recognize excellence in student projects, and (3) promote the sharing and exchange of ideas about team projects and undergraduate research among the members in the section.

Student Poster Competition Abstracts

The Southeastern Section of the American Society of Engineering Education (ASEE) has solicited extended abstracts from undergraduate students to present in a poster session at this year's conference.

Section 3 in this book contains the extended abstracts from this year's student participants. During a morning judging section, they will be evaluated on their abstract, poster, and communication skills. In the afternoon, the Research Division encourages all conference attendees to stop by and learn from students about the wonderful projects going on throughout the section.

Poster Specifications

Each poster shall be set on one 6-foot table. Posters shall be of standard presentation student presentation quality (typically made of corrugated cardboard), and shall stand on their own when opened. Participants may use tape, glue, or pushpins to make attachments to the poster. Special, professionally fabricated presentation displays will NOT be allowed. All supporting display material shall fit on the table with the poster in the space provided. Electrical power will not be supplied.

Monday, April 7, 2008 Technical Sessions

T1-A: Chemical & Civil Engineering 1 **Moderator: Paul Asunda**
"Course Improvement Strategies" **10:30 - 12:00, FEC 308**

T1-B: Computer Engineering **Moderator: Satinderpaul Singh Devgan**
10:30 - 12:00, FEC 215

T1-C: Civil Engineering 1	**Moderator: Scott Yost**
Student Engagement: P - 16	**10:30 - 12:00, FEC 219**

T1-D: Administrative Division 1	**Moderator: Jeffrey Fergus**
Integration and Interdisciplinary Activities	**10:30 - 12:00, FEC 123**

T2-A: Engineering Technology 1 **Moderator: Sherief Sheta**
Student Engagement **1:45 – 3:30, FEC 308**

T2-B: Instructional Division 1 **Moderator: Adrienne Minerick**
Technology In and Out of the Classroom **1:45 – 3:30, FEC 215**

T2-C: Administrative Division 2	**Moderator: Ken Brannan**
Issues Concerning Underrepresented Groups	**1:45 – 3:30, FEC 219**

T2-D: Administrative Division 3	**Moderator: John Brocato**
Assessment and Analysis	**1:45 – 3:30, FEC 123**

T3-A: Engineering Technology 2	**Moderator: Zhaoxian Zhou** **3:45 – 5:30, FEC 308**

T3-B: Research Division	**Moderator: Dirk Schaefer** **3:45 – 5:30, FEC 215**

T3-C: Civil Engineering 2 **Moderator: Michael Casey**
3:45 – 5:30, FEC 219

T3-D: Administrative Division 4 **Moderator: Priya Goeser**
Retention and Outreach **3:45 – 5:30, FEC 123**

T3-E: Engineering Technology 3	**Moderator: Ted Branoff** **3:45 – 5:30, FEC 218**

Tuesday, April 8, 2008 Technical Sessions

T4-A: Chemical Engineering 2 *Interdisciplinary Activities*	**Moderator: Jacquelyn Mobley** **8:45 - 10:00, FEC 308**

T4-B: Mechanical Engineering 1	**Moderator: Autar Kaw**
Materials and Design	**8:45 - 10:00, FEC 215**

T4-C: Professional Skills Division	**Moderator: Hodge Jenkins**
	8:45 - 10:00, FEC 219

T4-D: Administrative Division 5 **Moderator: Claire McCullough**
8:45 - 10:00, FEC 123

T4-E: Software Engineering **Moderator: Evelyn Brown**
8:45 - 10:00, FEC 218

T5-A: Civil and Electrical Engineering **Moderator: Michael Woo**
10:15 - 12:00, FEC 308

T5-B: Mechanical Engineering 2 **Moderator: Matthew Gordon**
10:15 - 12:00, FEC 215

T5-C: Civil Engineering 3	**Moderator: Thomas Dion**
Curricular Issues	**10:15 - 12:00, FEC 219**

T5-D: Administrative Division 6	**Moderator: Jessica Buck**
	10:15 - 12:00, FEC 123

T5-E: Management Issues and Industrial Engineering **Moderator: Barbara Bernal**
10:15 - 12:00, FEC 218

ASEE SE 2008 Conference Proceedings

The ASEE SE 2008 Conference Proceedings are provided in CD format to all full paying registrants and all program Deans of the Southeastern Section. To obtain additional copies of the CD version of the Proceedings, please contact

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ASEE SE 2008 Conference Registrants

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Aaron Ball	Western Carolina University
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Thomas Brackman	Northern Kentucky University
Kenneth Brannan	The Citadel
Theodore Branoff	North Carolina State University
Charles Bray	The University of Memphis
William Brewer	Jackson State University
John Brocato	Mississippi State University
Evelyn Brown	East Carolina University
Jessica Buck	Jackson State University
Juan Caicedo	University of South Carolina
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Lenly Weathers	Tennessee Tech University
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Blake Waggoner	Union University
Kristen Wallis	Clemson University
Francis Yore	Georgia Institute of Technology

Technical Session Abstracts

Civics and Homeland Security in a Chemical Process Safety Course

David L. Silverstein
University of Kentucky

EXTENDED ABSTRACT

Chemical plants, like other potential terrorist targets, are subjects of intense scrutiny as the federal government and other agencies seek to protect the public from harm. Engineering students must be kept aware of the role they will be expected to play in maintaining security in a plant environment and to protect the public from the worst of unexpected occurrences. With the rapid changes in chemical plant security that began well before 2001 and continue today, chemical engineering educators must be provided with current information pertinent to existing classes that will empower tomorrow's engineers to function effectively. Additionally, students are often unfamiliar with how the U.S. Federal Government interacts with industry to affect safety, security, and environmental policy.

A module developed to integrate topics in homeland security into a course in Ethics, Safety, and Professionalism is currently being used at the University of Kentucky, Paducah Extended Campus. This module introduces students to the role of government, industry groups, and individual plants in maintaining as safe an environment as reasonably possible in an age of terrorism. The focus of the module is to tie elements of the course and curriculum previously discussed to a rapidly changing contemporary issue. Topics tied to the module include the role of government (executive and legislative roles and current activities in both with regard to plant safety, previously introduced in the context of safety and environmental law), green engineering (just-in-time production, waste minimization), fail-safes, and risk analysis (HAZOP and other methods). New topics include site vulnerability analysis, ventilation security, and cybersecurity. Extensive documentation is provided, as well as references to the most current information available regarding plant security.

Incorporating Projects and Problems in a Thermodynamics Course to Improve Critical Thinking / Real-World Problem Solving

Donald P. Visco, Jr.

Department of Chemical Engineering, Tennessee Technological University

EXTENDED ABSTRACT

A common response from external assessment measures indicates that during the time students are on campus to earn their B.S. degree, the skills of critical thinking and real-world problem solving are not addressed in a satisfactory manner. To this end, I present the use of critical thinking questions and semester-long projects in a thermodynamics class as a backdrop for students to practice and develop these skills.

Pre and post-assessment results over the course of two semesters of thermodynamics indicate statistically significant progress in these areas. This presentation will provide the mechanism by which this technique was implemented as well as examples of questions and projects used during these courses.

Group Homeworks: A Mutually Beneficial Cooperative Learning Strategy

Adrienne R. Minerick

Dave C. Swalm School of Chemical Engineering, Mississippi State University

EXTENDED ABSTRACT

Excellence in teaching, research and service is expected of all faculty, but time to accomplish each of these tasks is in short supply. Newer faculty can feel torn when the expectations of their institution regarding promotion and tenure are research – focused while one of their passions is in the classroom. However, on rare occasions, a teaching strategy arises that saves the faculty member time while enabling enhanced learning on the part of the students. This abstract and corresponding paper will describe a cooperative learning strategy applied to student homeworks that saves the faculty member time. This strategy has been implemented in a senior capstone chemical engineering class as well as a junior level chemical engineering course. Slight modifications have been adapted in subsequent semesters in order to optimize the learning experience for the students. This paper will describe individual outlines and group homework structure, which ensures individual student accountability while facilitating student interactions that enhance understanding of important concepts. Since one complete homework assignment is turned in for every three students, the number of homework sets to be graded is significantly reduced. Student buy-in of the idea is also addressed including competitive incentives that encourage individualized hard work.

Homework is a well-honed, extensively utilized learning tool in engineering courses that enables students to practice solving problems. Since student homework is completed outside of the classroom, professors tend to encourage students to work with each other when solving the problems. Many professors encouraged students to freely discuss homework concepts amongst each another in order to formulate individual solutions. This mindset to homework is changed to a group homework strategy done in two stages. First, each individual student outlined his or her own solution strategy. This outline was to include a diagram of the system along with labeled quantities, etc, equations that would be used, narration of the desired solution strategy (flow diagrams were encouraged), and a statement on what range of values would make sense for the answer. The instructor collected these and provided feedback on the strategy outlined, pointed out any assumptions made, and provided guidance on any concept the student had not considered. Next, the instructor assigned teams of two to three students that worked together to develop a complete composite solution. It was required that this be done during a face-to-face meeting where each student participates in discussion at each stage of the problem. The benefits of the student cooperative learning forum for students are noted. The goal of this manuscript is to provide a complete guide for faculty to easily adopt cooperative learning in a limited capacity in their classrooms.

ABET Binders Simpler and More Efficient Approach to Map Program Outcomes and Educational Objective

Mario Oyanader, Venkat Subramanian, Joseph Biernacki and Pedro Arce

Department of Chemical Engineering, Tennessee Technological University

EXTENDED ABSTRACT

Preparing course binders for the program review by the Accreditation Board of Engineering and Technology (ABET) is usually a complex and time consuming task. Since ABET offers accreditation to engineering programs and not colleges or departments, as in the case of, for example SACS, and because they do not offer a template for successful accreditation, the spectrum of possibilities for a course binder collection is quite large. Traditionally, and based on the different curriculum and style of pedagogical learning, engineering departments have used a binder per every course and collecting almost about every piece of information possible. These include, for example, homework set, quizzes, projects, mid-terms, and finals. Also, traditionally, it seems the focus has been on presenting thicker and larger number of binders that only contain raw data but not necessarily meaningful information and analysis that show trends and suggest changes. It seems that, for the most part of the past history, lack of data processing and redundancy of information have been the driving management strategies used in a course binder collection for an ABET visiting review.

Now: Is it possible to change the above status and have a more rational-based strategy for the course binder collection? Perhaps, we should start with the basic questions: Why binders are needed in the ABET process described in the paragraph above? What is the exact role that they play in the review for an accreditation process? In summary: Is it possible to identify and/or design the type of binders needed for a successful accreditation from a "process synthesis" (or similar) points of view?

This contribution focuses on developing a sound strategy to make course binders an efficient and "economical" tool for the accreditation process. The core principle used here is *the mapping for program educational objective to program outcome*. The methodology also uses efficiently "decision tables" as filtering and/or processing media of raw data to generate relevant information to reviewers about the program outcomes and objectives. The most appealing result of applying this proposed strategy is the reduced number of binders necessary to effectively map ABET requirements and the systematic suggestion of type of data collected. The oral presentation will discuss, in detail, basic ideas, principles behind the process, and it will also give illustrative examples.

Using E-Homework to Provide Disaggregate Problem Solving Assessment in a Senior-Level Traffic Engineering Course

Steven M. Click, PhD, PE
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EXTENDED ABSTRACT

As with most senior level engineering courses, traditional homework problems in traffic engineering are multi-step problems which require lengthy solution times, leading to difficulty in both in the development homework assignments which balance time required with breadth of coverage and in the assessment of student work, especially when mistakes occur early in the solution process. As with exams, disaggregate assessment (or stepwise assessment) helps to minimize issues which arise from early errors in assessment. This paper first presents basic motivations for using and the process of developing disaggregate e-homework in a senior level transportation class.

The paper begins with motivations for using disaggregate e-homework in CEE 4630 – Traffic Engineering. These include the time required of the instructor, the time required of students, and the ability of a homework assignment to cover the breadth of topics covered in class. The paper then continues with an example of breaking a problem down into disaggregate parts. The sample problem was chosen for its simplicity, and its ability to be understood by those without a transportation background. The key element in this section is the process of breaking a problem down into its component parts.

The next section demonstrates the process of coding these parts into e-homework questions. While brief, this section touches on the basic capabilities of most course management systems, and gives screen-shots from the Respondus software which show the process of coding problems.

The paper then concludes with a discussion of the relative costs and benefits of using disaggregate e-homework assignments. While I have found that overall, the benefits seem to outweigh the costs, there are some trade-offs which must be considered and some potentially hidden costs which are noteworthy.

A Hands-on Approach to Computer Security Instruction

Rayford B. Vaughn Jr. and David A. Dampier
Mississippi State University

EXTENDED ABSTRACT

This paper describes a full semester upper level undergraduate and graduate level engineering course in computer security which has a lab component and an innovative end of the semester "Capture the Flag" contest that hones the computer penetration skill sets of the students in the class. The full paper describes the twelve laboratory experiences that the students are exposed to during a semester and the three class periods devoted to penetration testing tools and techniques to include the competitive capture the flag exercise at the end of the class during which students work in teams to penetrate systems and win prizes in doing so.

The paper also describes how students are motivated to write publishable papers which have resulted in more than twenty peer reviewed student conference and journal publications – several of which have earned "best student paper" awards at the conference in which they were presented.

Mississippi State University is one of the early National Security Agency designated Centers of Expertise in Information Assurance Education (CAE/IAE) which has greatly assisted the growth of the security program at MSU. While the paper itself concentrates on the security classes and hands on experience, the support and assistance from grant programs at NSF, NSA, Army Research Laboratory, and others is credited in providing the laboratories and infrastructure support to make the "hands on" approach viable.

A Laboratory Framework for the Synthesis and Analysis of DSP Hardware Systems

Tyson S. Hall

Southern Adventist University

EXTENDED ABSTRACT

Traditional curricula commonly separate digital signal processing (DSP) theory and very high-speed integrated circuit hardware description language (VHDL) modeling into different classes while providing students few opportunities to make an effective transition between these two skills. This type of approach leaves students poorly equipped to deal with the practical application of DSP theory in the design and implementation of hardware DSP systems. A pedagogical framework has been developed which focuses on bridging the gap between the theory of DSP and VHDL modeling of DSP systems. Students are presented with the concepts of DSP concurrent with their application in the design, simulation, synthesis, and testing of hardware systems. The synthesized hardware is implemented on field-programmable gate arrays (FPGAs), which provide a fast and cost-effective way of prototyping hardware systems in a laboratory environment.

This presentation explores an updated infrastructure for facilitating DSP hardware design laboratory projects. This infrastructure provides a conduit between MATLAB and hardware DSP systems implemented on an FPGA. The connection between the PC and the FPGA is implemented over a high-speed USB connection. VHDL modules designed to function with Altera's University Program DE2 boards implement the hardware side of the interface and easily integrate into students' hardware design. On the software side, custom drivers provide a link between MATLAB and the Microsoft Windows USB subsystem.

Prior implementations of this infrastructure relied on custom daughter boards to provide the high-speed communication between the PC and the FPGA. However, Altera's DE2 board has a USB 2.0 transceiver on-board that allows for a more straight-forward implementation of the communication interface. In addition, the DE2 board is equipped with a Cyclone II FPGA that is large enough to synthesize soft-core processors and also includes hardware multipliers embedded in the reprogrammable logic. These features make the DE2 board a convenient, cost-effective, and flexible rapid prototyping platform for exploring DSP hardware design.

Using the developed infrastructure, students can design and implement hardware filters, discrete-time transforms, and other DSP systems in hardware on an FPGA and analyze the response of their hardware system to input waveforms generated in MATLAB.

Construction of Parallel Machines for Engineering Courses with Retired Personal Computers

Yili Tseng and Claude M. Hargrove

Dept. of Electronics, Computer, and Information Technology

North Carolina A & T State University

EXTENDED ABSTRACT

Need for Parallel Computers

It is now clear that silicon based processor chips are reaching their physical limits in processing speed, as they are constrained by the speed of electricity, light, and certain thermodynamic laws. The only solution to overcome this limitation and boost performance significantly with current technology is to connect multiple processors working in coordination with each other to solve grand challenge problems. That is, parallel processing is not only a trend, but also the only choice. As the parallel processing techniques have matured over the years, parallel computing becomes more and more powerful. As most of engineering problems and courses are based on mathematical modeling which appreciates ample computing power, parallel machines make the best platform to carry out the computation.

Practical Issues for Adopting Parallel Computing

However, only major research institutes can afford supercomputers consisting of parallel machines because of their extremely expensive price. Thanks to the development of open source parallel processing library, now it is possible to build a powerful cluster out of commodity personal computers. Almost all institutions have accumulated plenty of retired personal computers over the years. Supplemented with free operating systems and parallel processing library, they can be built into a parallel machine without expense or with minimal cost.

Building Parallel Computers for Engineering Courses

Although those retired personal computers are slower than the high-end personal computers currently available, the performance of the cluster built with the retired personal computers is sufficient for education and training purposes. Offering parallel processing courses is no longer restricted by the resource issue. In this paper we will introduce procedures with necessary details to build a cluster using PC's and free parallel processing software, MPICH, an implementation of Message Passing Interface (MPI), so that every engineering discipline can take advantage of the computing power brought by parallel computers.

Seminar-Based Electromagnetics Education

Zhaoxian Zhou

School of Computing, University of Southern Mississippi

EXTENDED ABSTRACT

The importance of EM waves and fields problems can never be exaggerated. These problems arise in diverse areas such as radar systems, antennas, communication systems, electrical machines and apparatus, PCB, RFIC, RFID, Bluetooth, and other mobile techniques. However, electromagnetics education is always a difficult task in engineering and engineering technology curriculum, because of its nature of abstract math and physics. There are a great many of pedagogic practices in EM education, most of which can be classified into one of the three: traditional classroom lectures, hands-on experiments and projects, and simulation and multimedia tutorial software packages. In this paper, an innovative student seminar-based classroom practice is reported. The instructional process was illustrated by student-oriented theoretical inquiry of interested topics combined with traditional and emerging applications. Specifically, under the careful guidance of the instructor, every student or student group chose an EM topic of their interest and presented to the class; while other students or student groups were encouraged to pose questions and probe details that should be defended by the presenter. The class has been involved in various EM topics that allowed them to better grasp the significance of EM theory and gain physical insight into what could otherwise be a sea of mathematical manipulations. The student performance as a presenter and as an interrogator was evaluated by both the instructor and the peer students. Other practical issues are discussed in the paper. Qualitative analysis showed that the seminar-based instruction enhanced the students' interests in EM education, fostered their problem solving skills, and improved the learning experience

A Field Investigation of a Large Collapsed Structure:

A Student Engagement Project

Shane M. Palmquist and Ronald E. Gallagher

Western Kentucky University

EXTENDED ABSTRACT

A large private horse barn structure located in a small rural county in Kentucky collapsed during construction on October 14th, 2006. The horse barn was 80 ft wide by 120 ft long with 80 ft long wooden roof trusses. As the crane was bringing the last truss into position on the end wall, the entire roof truss system suddenly collapsed. The cause of the collapse was not immediately known. Several potential circumstances existed, which included: possible weather related conditions somewhat unique to south central Kentucky, the condition of the new trusses prior to installation, and the construction practices performed during erection of the trusses.

Within days of the collapse, students in a junior level structural analysis course got an opportunity to investigate first hand to determine the cause and the sequence of events that lead up to and during the collapse. Based on documented site visits and on statements given by the contractors and the owner, who were present at the time of the collapse, students were required to investigate and write a report to determine the cause and nature of the collapse. The focus of this paper is to present the results and work performed by the students, and to give an assessment of the project.

Model Bridge Building Competition An Outreach Project to get High School Students Involved in Engineering

Atin Sinha

Albany State University

EXTENDED ABSTRACT

It is now well known that success in engineering studies largely depends on advance preparation in science and mathematics. As such most high schools encourage students' participation in science projects that require critical thinking in design and analysis as an exciting introduction to a career in science and technology. Southwest Georgia Regional Model Bridge Building Competition traces its roots to a cooperative endeavor of a group of engineers working in academia, R&D and private industry to motivate young students in rural Georgia to take a serious look at a possible engineering career. A secondary objective is to attract students to the transfer engineering program conducted by Albany State University in conjunction with Georgia Institute of Technology. The competition opened to all high school students in the southwestern part of the state, started in 2003 and was held in Albany State University every year on the last Saturday of the month of February celebrating the National Engineers Week.

Working as a team of 2 or 3, students get a chance to solve realistic engineering problems by designing and building a structurally efficient balsa wood bridge according to very demanding specifications and showcase their design before a panel of judges. The competition is held in two categories, short (22") and long (33") span. The top three teams in both categories, judged by structural efficiency (ratio of the breaking load to the weight), are awarded prizes. The event is funded by NASA sponsored Georgia Space Grant Consortium. The intensity and the seriousness of the competition have been reflected in the fact that the best efficiency has grown steadily from 366 in 2003 to an astounding 560 in 2007. Though there is no direct correlation, the bridge contest has definitely increased the visibility of Albany States University's Engineering program as is reflected in the increased enrollment from 12 in 2001/2002 to 34 in 2006/2007.

K-12 Exposure to Water Quality, Treatment, Resources and Management at the Florida Aquarium as an Outreach Activity During a Large Professional Conference

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[3]American Society of Civil Engineers, West Coast Branch, Florida Section

EXTENDED ABSTRACT

In May 2007, the Environmental Water Resources Institute (EWRI) held its week long World Environmental Resources Congress in Tampa, Florida. For the first time, EWRI sponsored an outreach activity as a part of the congress to take advantage of the presence of a high concentration of academic and professional human resources in fields related to water quality, treatment, resources, and management. The Outreach Activity committee consisted of local professional engineers, and University of South Florida (USF) faculty, staff and students. The main objectives of the activity were to increase awareness of K-12 students on issues related to water relevant to living in Florida, and to broaden participation of students in STEMs fields with an emphasis on environmental engineering. It was held at the Florida Aquarium and targeted a total of 125 elementary, middle and high school students from the Tampa Bay area. Schools were selected based on student demographics, presence of an interested and willing teacher, and appropriate class focus. Four schools participated and the day's activities were divided based on the grade level group with volunteer mentors from the Congress and USF and assistance from the aquarium staff. Undergraduate volunteers mentored elementary students whilst professional engineers and faculty volunteers mentored the older students. Elementary students potted mangrove seedlings, explored the aquarium's wetlands exhibit and sampled the stormwater treatment ponds. Middle school students focused either on stormwater management, including sampling, treatment and water quality testing, or water treatment which included a behind the scenes tour of the aquarium, with treatment and quality testing classroom exercises. High school students interacted with mentors during a mangrove planting exercise on a nearby island, a behind the scenes aquarium tour and a visit to the conference exhibition hall. Student surveys done at the beginning and end of the outreach activity suggested that students left with a better understanding of the water related concepts that they were taught and the environmental engineering profession.

Fostering Critical Thinking Skills in an Environmental Engineering Water and Wastewater Treatment Class through a Hands-On Semester Project

Lenly J. Weathers

Tennessee Technological University

EXTENDED ABSTRACT

Students in an undergraduate environmental engineering water and wastewater treatment class were asked to develop and demonstrate a low-cost, energy efficient, simple and reliable system for use in removing silica from brackish water prior to desalination. After performing a literature review, each student team investigated several possible treatment options with laboratory experiments. After designing the system, each team produced a written report. Among other items, the report discussed the various technologies considered and why the selected technology was chosen. Student groups also produced a poster presentation of their system as well as a PowerPoint presentation. Team members then participated in the WERC Design Contest in Las Cruces, NM.

This project was undertaken as part of a university-wide effort to foster critical thinking among undergraduates. To determine the effectiveness of the project on students' critical thinking abilities, pre- and post-project assessments were conducted. Analysis of the results revealed statistically significant progress in the following thirteen measurements of critical thinking: 1) learning to apply material, 2) acquiring skills in working with others as members of a team, 3) developing skill in expressing themselves orally or in writing, 4) learning to separate factual information from inferences, 5) interpreting numerical relationships in graphs, 6) identifying inappropriate conclusions, 7) identifying and evaluating evidence for a theory, 8) identifying new information that might support or contradict a hypothesis, 9) separating relevant from irrelevant information, 10) integrating new information to solve problems, 11) learning and applying new information, 12) using mathematical skills to solve real-world problems, and 13) synthesizing and organizing ideas, information, or experiences into new, more complex interpretations and relationships.

Mississippi Summer Transportation Institute 2007

Donna S. Reese, Emma E. Seiler, Dennis D. Truax
Mississippi State University

EXTENDED ABSTRACT

In the summer of 2007, Mississippi State University's Bagley College of Engineering was awarded a grant from the Mississippi Department of Transportation (MDOT) to host the 2007 Mississippi Summer Transportation Institute (MSTI). The MSTI is a three-week residential program for 19 rising high school sophomores and juniors. The focus of MSTI was how science, technology, engineering, and mathematics (STEM) related to transportation and career opportunities in transportation.

The MSTI included hands-on activities, development of communication skills, and utilization of technology and skills required in today's workforce. Field trips to the Nissan plant, Mississippi Department of Transportation (MDOT), and the Columbus, MS Air Force Base exposed students to real-world applications of STEM and introduced them to a wide range of careers in transportation. Curriculum included sessions about structural systems, system illustration (CAD), transportation system layout, hydraulic engineering, environmental and water resources engineering, pavement materials design, building materials design, and traffic management. Leadership training and team building activities were also included.

According to student feedback, there was an increase in interest across all subject areas after their participating in the MSTI. Post-program follow up also suggest that the MSTI had a positive effect on encouraging participating students to take more science and math courses. When asked how MSTI will influence their career choices, some of the participants specifically noted overall desires to become engineers. The more specific comments included, "I will most likely be an engineer and MSTI has helped with that choice." "This camp has enforced my interests in engineering…" "This camp definitely made me want to be an engineer."

This paper will present the overall curriculum of the MSTI camp with specific emphasis on activities that could be implemented at other institutions. In addition, detailed assessment results of each activity will be presented to help institutions interested in implementing similar camps to chose activities which appear to be of most benefit to the students.

Development of 'Material Selection' Curriculum in an Integrated Science and Technology Program

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EXTENDED ABSTRACT

The Integrated Science And Technology (ISAT) program is an innovative integrated multidisciplinary applied science program that is established on issue-based curricula. The curricula address critical technology disciplines that are imperative to today's competitive economy. The disciplines are incorporated into sectors of engineering/manufacturing, energy, bio-systems, environment, information/knowledge management, and telecommunications.

The main premise of the ISAT program is to graduate students who are life-long learners who are capable of solving multi-disciplinary technological problems. ISAT graduates are unique in having breadth of 'Foundation' knowledge and skills across the above mentioned sectors. The students learn and develop their Foundation knowledge in the freshmen and sophomore years. Later on, in the junior and senior years, students develop depth in selected sectors. Depth that is needed to enable them competing for jobs that are normally attract graduates from traditional programs.

Several challenges should attend to when curricula are developed for an integrated multidisciplinary program like ISAT; two are addressed here. The first is the integration of contents and balance between breadth and depth. The second is the preparation of students and their readiness for integrated curricula. The two challenges are exemplified in the Material Selection curriculum (ISAT 432) which is a *required* course for students taking the manufacturing/engineering sector and an elective for students in the energy sector.

With regard to the first challenge, the integration of contents reflects the breadth in the Material Selection course. Its curriculum is comprised from traditional curricula (such as strength of materials manufacturing processes, and cost estimation), evolved curricula (such as Material Science which evolved from traditional Metallurgy and Chemistry curricula), and the ever-evolving curricula (such as green engineering and sustainability). The depth in coverage of selective contents is dependent upon currently debated issues (such as sustainability, energy).

As for the second challenge, the majority of transfer students to the ISAT program, whether internally or externally, come from traditional educational programs without the perquisite multidisciplinary 'Foundation" knowledge. The same applies to students who take ISAT junior/senior level courses as electives in their respective programs (such as Industrial Arts, Chemistry).

The author will talk about his experience in dealing with the above challenges using group term projects, research term papers, and lecturing.

An Example of Vertical Integration in an Engineering Curriculum

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EXTENDED ABSTRACT

In many traditional engineering programs, the first two years of study focus on core concepts and principles. At East Carolina University (ECU), our general engineering curriculum seeks to reinforce core concepts throughout the four years of study using vertical integration of key components. In this paper, we present details on the type of activities and assignments necessary to provide vertical integration of modern engineering tools. Although the details are based on how our curriculum integrates modern engineering tools, the types of assignments and their role in the integration process can be generalized and applied to other concepts in the curriculum.

Purpose

The purpose of this paper is to describe how the Engineering curriculum at East Carolina University uses vertical integration of modern engineering tools to enhance learning and deepen the sophistication with which students can apply a software package to solving engineering problems. This paper is descriptive research and provides details on the modern engineering tools our curriculum utilizes, the courses in which the tools are taught or applied, and the level of advancement of the tool as it is progressed through our curriculum.

Limitations

Our Engineering program is new, with our first graduates completing receiving their degrees in May 2008. For this reason, we do not yet have data to validate the effectiveness of our vertical integration approach. In the future, it is our hope that the assessment rubrics, course assignments and semester projects we employ will allow us to determine the skill levels our students have with each of these tools. In the upper-level courses, it may be possible to administer pre and post tests to evaluate if the reinforcement of concepts is effective. These types of analyses will be presented at a later date.

The KNEED Program: A Novel Model for Small High-Tech Business and University Cooperation

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EXTENDED ABSTRACT

The vast majority of participants in the University of Kentucky's engineering cooperative education program were placed outside the Commonwealth, primarily with large companies, in the program's early years. Many of these students accepted full-time positions with their co-op employers, consequently leaving the state and contributing to a "brain-drain" problem. Recent economic trends have great implications on the need for and education of our high-tech workforce. As companies increasingly focus on the gains afforded from innovation, the most important assets for many firms are the innovators. The increased workforce demands result in new economic development strategies, one of which is a focus on attracting skilled workers to live in one's region. Failing to attract and supply an educated, innovative workforce in a knowledge economy would lead to a decline in new economy job opportunities within the region and ultimately fuel a continued reduction in student enrollment in science, engineering, and technology degree programs, especially at institutions within one's region. To address this brain-drain, the Kentucky New Economy Engineering Development program was established to encourage potential co-op students to consider employment with high-tech, small businesses within the state. Funded via a grant from the Kentucky Office of the New Economy, the KNEED program utilizes engineering co-ops to assist Kentucky's high-tech start-up companies. For a prospective company, the program addresses their technical needs without requiring them to hire a full-time engineer by providing labor cost subsidies. In return, the company educates the student about the business and leadership aspects of running a small, tech enterprise.

An educational objective of the KNEED program is to have UK engineering graduates become familiar with small, high-tech companies. By understanding the business and leadership aspects of running such a company, students will be less reticent to accept permanent job offers from such companies. A long-term goal of the program is for KNEED students to eventually start their own high-tech companies and create employment opportunities for future graduates. While it is a program goal for participants to bring an excitement and aptitude for the business and technical aspects of running a company, it is important to create an environment that will foster this entrepreneurial spirit as the students return from their co-op placements. The KNEED program coordinator works with the students and employers to connect them with local entrepreneurial resources, furthering a network of support that can increase the likelihood of success.

The paper and presentation address the motivations, implementation, peripheral support methods, and preliminary evaluation of the KNEED program. However, the limited number of program participants compounded with the current survey response level necessitates a more anecdotal discussion of the program's successes—one which is based on personal responses from co-op student and entrepreneurial business owner participants.

Teaching Engineering and Science Students Computer-based Measurement Systems using Real-World Applications

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EXTENDED ABSTRACT

Computer-based measurement systems are growing at a very fast pace in industry. However, engineering students in various engineering disciplines receive limited or no training and/or education in this field. This problem could be due to the following reasons: cost of laboratory equipment and instrumentation, lack of enough expert educators, and lack of a dynamic pedagogy that encourages students to get more engaged in this field.

One way to improve student engagement in the field of computer based measurement systems is to supplement the subject matter with small to medium size practical projects that are easy to identify and interesting to implement.

The projects may be implemented in two phases. In the first phase, simple projects are utilized to introduce students to the concepts of computer-based measurement systems using ready-to-use systems to simply record data from applications under study. In this phase, students should not be required to develop programs and codes for the measurement systems. However, they should perform analysis on the recorded data. In the second phase, students should develop codes that perform data acquisitions and measurement analysis for the problem under study. This requires students to understand many details associated with computer-based measurement systems such as, system setup, sampling rate, code width, resolution, limit setting, signal-to-noise ratio, signal conditioning, etc.

We have used several practical projects to teach students applications of computer-based measurement and instrumentation. These projects involve vibration and temperature measurements for equipment such as washing machine, dryer, space heater, and air conditioning system. Students collected measurement data using a laptop computer equipped with data acquisition capabilities and computer-based measurement software systems. They utilized the data to perform engineering analysis and gain basic knowledge about condition monitoring techniques.

This paper describes a number of real-world projects that may be used to enrich student's learning in computer-based measurement systems. Our experience shows these practical activities increased students' interest in the subject and make them more involved in the learning process.

Beyond the Barriers: The Incorporation of Service Learning in Technology Programs

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Jackson State University / Mississippi State University

EXTENDED ABSTRACT

Technology is constantly utilized in unlimited facets of society. It promotes the applications of natural resources to endorse societal enhancement. With such emphasis on the community at large, careful and strategic consideration can be made to incorporate technology and service learning to foster continued amplification for faculty, students, and the community.

Technology students should be provided opportunities to participate in service learning activities to enhance their awareness of societal needs, and they can assist in efforts in fulfilling those needs and other demands. Technology students should be able to assess communal needs, and adequately apply technological means that will improve the quality of existing conditions. By incorporating service learning projects into courses, this plan of pedagogy will:

- promote preparation in technological applications, such as computer technology;
- develop students' comprehension on the pedagogy of technology integration;
- identify a communal need such as computer literacy, in which technology students will assist in fulfilling;
- devise training sessions that will minimize computer illiteracy; and
- provide strategic methodology and future recommendations.

With such consideration being at the vanguard to educational and societal enrichment, there is an apparent demand for technology literacy, especially in our lower social economic areas. Some people usually avoid from technology and computer utilization for numerous reasons: 1) they have never been properly introduced and instructed on computer technology utilization; 2) they have never been informed on the benefits of using computer technology for personal needs; and 3) they have never been informed on the information and the entertainment components of computer utilization. However, completion of proper training will minimize the computer illiteracy issue, and give students the opportunity to apply classroom knowledge that has been acquired.

Academic Support Services and Student Engagement: Strategies to Improve Student Retention and to Promote Student Professional Development

E. Bernard White
George Mason University

EXTENDED ABSTRACT

The Volgenau School of Information Technology and Engineering (IT&E) at George Mason University (GMU) offers seven undergraduate majors. Total enrollment in these programs is approximately 2200, with the largest group of students enrolling in the Bachelors of Science in Information Technology (BS-IT) program. As with most large State universities, academic backgrounds of entering students can vary significantly, even for students choosing the same major. Additionally, degree requirements for different majors within The Volgenau School of IT&E run the gamut, from mathematics, science, and computing intensive courses for the engineering and computer science programs to the somewhat more business and applications oriented courses for the BS-IT program.

Retaining and graduating students within their initially selected major (or in another information technology and engineering major) presents many challenges for both the high profile and lower profile categories of students alike. In addition to having a solid foundation in mathematics and science, research literature shows that academic support services and activities that engagement students in their learning and learning environment improve retention and graduation.

With this as a backdrop, this paper provides an overview of a systematic process that has been implemented to increase retention and graduation rates for the various categories of undergraduate students who enroll in one of The Volgenau School of Information Technology and Engineering majors at George Mason University. More specifically, this paper describes the strategies and their associated activities that are the focus of our efforts. These strategies are centered on the following:

- Quality educational programming.
- Supportive educational environments.
- Active and collaborative learning.
- Student-faculty interactions.
- Enriching educational experiences.
- Challenging academic programs.

This paper should be of interest to other engineering schools that are examining retention models employed by various engineering school, with special attention to their undergraduate students who are their best and brightest as well as students who are of a lower profile.

Using Student Engagement Projects in an Engineering Technology Program to Stimulate Regional Economic Development

Robert Anderson, Ed. D., Phillip Sanger, Ph. D., Michael Smith, Ph. D.
Western Carolina University

EXTENDED ABSTRACT

Western Carolina University (WCU) is a comprehensive regional university of approximately 9000 students, 52 miles southwest of Asheville, in the Smokey Mountains of rural North Carolina.

As a major public resource for western North Carolina, the university assists individuals and agencies in the region through the expertise of its faculty, its staff, and its students. The university also assures this interaction, or "engagement," by requiring faculty members to participate in engagement as one of the requirements for tenure.

In support of engagement, students in an engineering technology logistics class were encouraged to develop team partnerships and work with regional companies to solve supply chain management issues. Seven groups did logistics projects for businesses in the spring 2006 class Student teams traveled to regional companies, consulted with stakeholders, and developed proposals which were delivered as formal papers and presentations to the client. Students gained experience in applying theoretical classroom instruction in a real-world setting. They also gained experience in teamwork, project planning, engineering proposal presentations, and working in an environment where their work made an impact on the economic well-being of people in the region.

Student evaluation of teaching on the end-of-class surveys indicated that they enjoyed the course format and felt that they had learned the material. Students commented that the class was much more fun and interesting than they had expected.
From a faculty perspective, students were perceived through the synthesis of learning and application to have gained greater integration of knowledge, increased student learning, and improved retention compared to the traditional lecture methodology.

Active Learning Teaching Methods Used in Information Technology Classrooms

Angela Lemons
North Carolina A & T State University

EXTENDED ABSTRACT

Teaching methods need to be innovative so students will not get bored in the classroom. Learning should be fun and not feel as if it is being forced upon. Classroom participation is a key element in making teaching methods innovative. When students participate within the classroom their retention of the material that is presented is increased. Their understanding of the material may also be increased.

There are various methods that one could use when identifying innovative teaching. Instead of using projectors and PowerPoint presentations, you could use interactive equipment. You can use a document camera in which you can place parts, pictures, and use PowerPoint presentations with. So instead of passing materials around the room and the students being distracted you can just place the material on the camera. This will allow the teacher to have a discussion while everyone is able to view whatever you placed on the document camera.

Another piece of technology one can utilize is a qwizdom interactive learning unit. This unit will allow each involvement of every student by posing objective and subjective questions during lecture, review, and testing. If you have students that are afraid to answer questions in front of everyone, this tool can come in handy. You can ask questions and each student can answer the question with their unit. By using this part of the unit, you will be able to track performance over time, and tally all scores, allowing you to effectively document, manage, and educate your class and streamline your processes.

There are many other innovative technologies that can be utilized in a classroom setting to enhance student learning. These technologies can also assist the teacher in many ways other than teaching. It can give reports on the quizzes you gave by student or by the question. This will allow you to see what areas students are having problems with and what areas students are excelling in. Any test or quiz that is given through the system will be automatically graded. This can save teachers time when it comes to grading assignments.

Remote Labs for Online Courses with Hands-On Work

Andy Ju An Wang
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EXTENDED ABSTRACT

One of the challenging issues for distance education is providing a "hand-on" laboratory experience allows students to acquire the application and problem solving skills expected for engineering and technology students. There are a number of "virtual labs" or software simulations for some of the information technology courses, but they do not fulfill the educational objectives of our IT programs, because students gain little real, hands-on experience out of those virtual labs. Our idea is to design and implement a remote lab that allows our students to participate in the lab exercise by remotely configure the hardware devices physically installed in our lab rooms. This can be done through three approaches: (1) using a physical layer switch, (2) using relay cards, and (3) using an internet camera. The first or second method is good for individual students to practice lab exercises remotely, while the third approach requires that one student, or a teaching assistant (TA), be operating the lab equipment in the lab rooms, working with other remote students anywhere through the Internet camera and broadband connection. The third approach is especially good for a team project with significant hands-on experiment. This paper is organized into two parts: the first part compares different approached to implement a remote lab for IT education in terms of their strength and limitation in scheduling, remote access, usability, reporting, and assessment. The second part present our design ideas for a remote lab supporting both hands-on and team work. The ultimate goal is an e-learning environment where students are provided with remote access to computing resources, and students will work in a virtual collaborative community. The result of this project will benefit online courses and onsite courses as well. This is a cost-effective solution for distance teaching/learning and share computing resources effectively.

The author will present the first phase of this project with the emphasis on the challenges and limitations of current solutions for remote labs in distance education.

Instructional Technology Tools: Exploring What's New

Mohammad Obadat and Steve Holt

Assistant Professor of Engineering/Director of Web Services

EXTENDED ABSTRACT

The teaching or (instruction) development techniques progressed through the years in the diversity of the implemented methods. The current era of instructional methods carry more weight on the use of technology as a teaching and learning tool. Technology tools used are useful in the instruction of lectures, preparation of presentation, and organization of class needs. This paper attempts to describe the main technologies used at The University of Tennessee at Martin. The concept and usefulness of the technology and examples of applications are also presented. The instructional technologies implemented on campus are classified as In-classroom tools and On-line tools. The technologies implemented and promoted over the UT Martin campus are employed as equipment, software, or a combination of both. Both up to date technological equipment and software are jointly used to produce manageable and productive courses. In-classroom tools include preparation software such as PowerPoint, Keynote, Camtasia4, Dream weaver, and Photoshop. In-classroom equipment include tablet P.Cs. Apreso classroom setups, projectors, and media equipment. On-line tools include web tools, real time, Blackboard, and individual websites. Examples of On-line tools are iTunesU podcasting, Adobe presenter, secure streaming server, Adobe connect, quiz manager, Blackboard safe assignment, gradebook, and wimba voice tools. The University of Tennessee at Martin has an Instruction Technology Center (ITC) that is responsible for providing facility and access to the tools listed in this paper. Resources of the ITC include a computer lab with up-to-date hardware and software, plus hands- on training classes offered throughout the year. Adaptations of the technologies vary widely amongst the faculty where some prefer the traditional overheads, others show interest in the use of supplementary modern technology, and some use all the up-to-date instructions tools in all their classes. Future plans for the ITC is to have access to additional technological tools that are necessary for the educational process such as an assessment-creation tool - Respondus, Lockdown browser tool, and project-oriented Blogs and Wikis. Exposure to new instructional technologies is beneficial to many instructors who may find solutions and ideas for many of their classes needs. No doubt that there are many technologies used on many campuses that might be similar in concept but it is important to have dedicated facilitators who help promote and educate the faculty and staff about the available resources.

A Method to Improve Course Instruction by Utilizing Teleconferencing Techniques

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North Carolina A&T State University

EXTENDED ABSTRACT

Some faculty at North Carolina A&T State University in the School of Technology has adopted the use of a teleconferencing room to conduct their lectures. In the past classes were conducted in a classic classroom environment where students passively learned through taking notes written on dry erase boards. Often traditional lectures are geared for those who write fast, and are able to memorize key bits of the lecture. The traditional method also limited the material covered for a given technical course. Valuable class time was wasted on writing/drawing diagrams as related to the subject matter. Slides or transparencies could have been used that would have allowed instructors to maximize the material covered but limits student engagement in lectures. An alternative approach involving teleconferencing aided instruction by efficiently utilizing lecture time. This new approach enabled the authors to take advantage of the visual and audio aids of this environment by allowing them the ability to demonstrate software and provide a means to disseminate lecture material. Skeletons of lecture notes (including relevant figures and diagrams) were provided to the students so that they could work problems interactively with the instructors during the limited class time. Each lecture is also recorded for future reference by the students currently enrolled in the course as well as online students that desire classroom instruction as a supplement. This article highlights (1) the authors experience in utilizing the teleconferencing environment for instruction, (2) the impact on student learning, and (3) a future innovation to improve student learning capacity through more effective teaching methods.

Hands-on Learning with Computer Simulation Modules for Dynamic Systems

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EXTENDED ABSTRACT

While the mathematical development and solution of dynamic equations of motion for mechanical systems is readily accomplished by engineering students, physical insights based on these equations is not. Interactions of multiple degrees of freedom as well as the consequences of modeling assumptions for dynamic systems are especially difficult for many students to grasp. This paper presents a series of in-class computer simulation modules on modeling of dynamic systems for hands-on learning, suitable for undergraduate courses in dynamic systems or vibrations. Simulations provide a means for students to visualize solutions and investigate alternative modeling or simplifications such as linearization of small angles, via graphical tools for plotting acceleration, velocity, and displacement results. Comparisons between linearized models and more complex nonlinear models help students determine the appropriate application of nonlinear modeling. These computer-based, visualization modules also offer students a vehicle for further inquiry, improved comprehension, and increased learning opportunities both inside and outside of class.

Simulation and modeling with Matlab® and Simulink®, of various mechanical systems was accomplished through four classroom modules. Module topics included: one degree of freedom (1-DOF) free vibration, 1-DOF forced vibration with harmonic forces, 2-DOF free and forced vibration, and simulation of an earthquake on a 4-DOF structure with actual acceleration data from the 1940 El Centro earthquake. Computer-generated solutions were compared to closed-form solutions for several of the studied systems, establishing a means for verification of results. Transfer function and state space representations of linear, time-independent, multiple DOF systems as well as graphical-based modeling of linear and nonlinear systems via a function block and signal flow diagrams were applied in the modules.

Instructional materials for the classroom computer exercises and the associated semester project, forming the basis of the modules, are provided and discussed in the paper. While resources for this module were developed for specific software, the concepts and topical problems presented for investigation may be used with other modeling and analysis software. The module materials may also be used by students as self-paced tutorials on modeling and simulation of dynamic systems.

Cell Phones as Tools for Learning, Information, and Security on Our Campuses

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EXTENDED ABSTRACT

Studies have shown that cell phones with powerful features are becoming common among college students. Cell phones are also very portable, and are brought into the classroom by students. Some of the modern cell phone features that can be used to enhance teaching include: Internet access, text messaging capabilities, digital cameras, and video recorders.

This paper discusses examples of how cell phones have been used as teaching tools. An example is given on how the SMS (Short Messaging Service) or text-messaging feature of cell phones has been used to conduct classroom experiments. Another example is giving on how text messaging has been used for interactive quizzing in a class. In addition to text messaging, the audio and Internet access features of cell phones have also been used to support language instruction. Examples of the use of these features to support English language instruction and Chinese language instruction are given. This paper also gives an example of how the video recorder feature of a cell phone was used in a class project that required the creation of multimedia images.

Other uses of cell phones on the campus are also discussed in this paper. These include using cell phones to disseminate emergency information, such as weather and security alerts. The Internet access feature of cell phones has also be used to access campus information on websites that are specifically designed for access by cell phone web browsers. Some examples of schools and providers of these services are given in the paper.

Integration of Distance Learning Technology into Traditional Engineering Physical Laboratory Exercises

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EXTENDED ABSTRACT

The use of distance learning technology in distributed educational environments has allowed engineering courses to be delivered to locations and populations that have historically not been afforded opportunities for involvement. However, as of today, efforts to incorporate distance-learning principles into physical laboratory exercises have not led to a general mechanism or procedure for performing physical labs remotely. Moreover, in the absence of sufficient laboratory resources at the remote site, the usual practice is to remove these exercises from the course. This, by no means, can be a satisfying solution since physical laboratory exercises are a vital component of any educational curriculum in virtually every major field of engineering. Although the types of laboratory exercises have some significant differences, there are a number of common characteristics that are identified as consistent within this educational approach:

1) The requirement that students actively participate in the laboratory exercise, rather than passively assimilate information presented by a second party.
2) The inclusion of physical products or materials in place of abstract theoretical constructs.
3) The need for students to make intermediate decisions during the exercise that will ultimately influence the final outcome of the experiment.
4) Analysis of the validity of results through proof-testing, comparison to accepted standards, etc.

The Georgia Tech Regional Engineering Program (GTREP) is an academic collaboration between Georgia Tech and its three partner institutions Armstrong Atlantic State University, Savannah State University, and Georgia Southern University. During freshmen and sophomore years of the undergraduate program, students are enrolled through one of the three partner institutions. Prior to their junior year, students apply for transfer admission to Georgia Tech and complete their degree program as Georgia Tech students. During their junior and senior years, students are taught by Georgia Tech Savannah faculty supplemented by distance learning connections. While any traditional course can be taught remotely between the GTREP institutions, it is still not feasible to cover physical laboratory exercises. Thus, at present, students attend pre-laboratory classes remotely but have to physically meet at a particular location to carry out the practical parts of the various laboratories. In order to overcome this barrier of contemporary distance learning, GTREP faculty teamed up to collaboratively develop an innovative approach to integrating distance learning technology into traditional engineering physical laboratory exercises. An overview of this project and findings related to its initial phase are presented in this paper.

Surviving Engineering: From a Minority Female Perspective

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EXTENDED ABSTRACT

As a practicing female under-represented minority in the field of engineering, I have spent the past 20 years wondering what I could do to help in the retention and development of minority and women engineering students. I have always felt that I represented a unique perspective as one who has lived through the struggle and survived. I wanted to believe that things had changed over the years since my undergraduate graduation in 1983. However, based on my recent experience with engineering academia and engineering literature, I am discovering that very little has changed. I feel compelled to stand in the gap and serve as a bridge for change.

This paper highlights my struggles through one of the most respected engineering programs in the country. By using a timeline format, I strive to demonstrate the pitfalls and triumphs along with key turning points which brought an aspiring overachieving high school student to an unsupported struggling undergraduate student with low self esteem and to a successful professional engineer today.

Building Bridges: Providing Special Programs for Minority Retention

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Auburn University, [1]AT&T Minority Engineering Program / [2]Materials Research and Education Center

EXTENDED ABSTRACT

Minority students face multiple barriers in higher education which contribute to their higher rates of attrition. These barriers may include insufficient academic preparation, lack of financial assistance, inadequate support services, and deficient role modeling. Additionally, the climate at predominantly White universities reflects the dominant majority, which can further create barriers for minority students. Special assistance is often needed if minorities are to succeed.

The focus in this presentation is on one such assistance program and how it has impacted the advancement of minority engineering students. The program uses a multifaceted approach and includes the following components: An Interactive Learning Lab, which is designed to provide a structured learning environment where at-risk students receive supplemental instruction; A Shadow Mentoring program wherein mentors work with the freshman minority students to monitor their progress and offer counseling; Collaborative Learning Groups, in which freshman students are placed in a like-subject collaborative learning group that is facilitated by upper-level students proficient in that subject; One-on-One Tutoring and Peer Tutoring, in which freshman students, who need extra help in a particular course, are tutored on Sunday evenings by a team of volunteer upper-level students proficient in the subjects being taught; and Academic Excellence Workshops, in which upper-lever students, alumni, and volunteer corporate representatives make presentations addressing topics such as time and financial management, diversity, study strategies, listening skills, note-taking and test-testing strategies.

These program components combine to create an environment that fosters student success and has led to improvements in retention and increases in graduate rates. Institutes of higher learning must commit to such multifaceted approaches to providing assistance for minority students to ensure that a diverse and inclusive workforce is available in the developing technological and globally competitive environment.

INSPIRE: A Low-Cost, Urban Pre-College Engineering Program

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University of Louisville

EXTENDED ABSTRACT

Purpose
A review of current literature shows that while under-represented minorities (URMs – e.g. African Americans, Hispanic/Latinos, Native Americans) constitute nearly 20% of the U.S. population, they only comprise 6% of the practicing engineers. (Bachnak, 2004). With regard to degrees awarded in the various engineering disciplines, Caucasians earn 77% of those degrees while African Americans only earn 2.4%. Hispanic/Latinos earn only 1.5% (Kaplan, 2003). Introducing and recruiting URMs to engineering is a national problem that must be addressed with targeted strategies (Chubins, May and Babco, 2005).

For more than 20 years, the University of Louisville has conducted the INSPIRE pre-college program. INSPIRE is an acronym for **I**ncreasing **S**tudent **P**reparedness and **I**nterest in the **R**equisites for **E**ngineering. The primary purpose of the program is to expose ethnic minority students and females to the various fields of engineering offered at the University of Louisville. The ultimate goal of INSPIRE is to increase the number of students historically under-represented in engineering, particularly at the University of Louisville.

Methodology
This research will highlight a low-cost, urban summer pre-college program targeting students under-represented in engineering. With respect to its impact on minority engineering recruitment, particularly in urban communities, the program has been one of the intervention strategies used at the University of Louisville to introduce URMS to various fields of engineering.

The INSPIRE program is conducted Mondays through Fridays from 9:30AM to 12:30PM during the month of June. The students utilize the classroom and lab facilities at the University of Louisville's Speed School of Engineering. The sessions consist of a combination of brief introductory lectures followed by hands-on activities, often in teams. Traditionally the sessions use a quasi-problem based on learning approach as opposed to a lecture-based format. Thus, most of the INSPIRE sessions are highly interactive resulting in the students applying their newly-acquired technical knowledge and skills in problem solving with practical applications.

Participants
An ultimate goal of the program is to increase the number of under-represented minorities who enroll at the University, particularly in engineering. Between the years of 1981 and 2004 a total of 609 students participated in the INSPIRE program. Personnel in the Office of Institutional Research and Planned assisted us in "tracking" the students who subsequently enrolled at the University of Louisville. There were 433 matches found. This represents 71% of our cohort. Of those 433 students, 175 (40%) persisted and completed degrees from U of L.

It was determined that 76 (out of the 175) students were awarded the bachelors or masters degrees in engineering (43%). Seven students completed associates degrees. There were also other math/science degrees awarded to former INSPIRE participants: 7 medical degrees, 9 degrees in biology, 6 in math and 1 in CIS.

Research is now underway to "track" former INSPIRE students who enrolled at other colleges or universities.

Conclusion
An overview of the INSPIRE program, selected activities, costs and outcomes will be described. Critical success factors, anecdotal observations, and challenges faced by program personnel will be presented.

Involvement of Women Engineers at Mercer University

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EXTENDED ABSTRACT

The goal of this research was to evaluate the position of students and faculty woman engineers and to report their perception regarding belonging to the community of the School of Engineering at Mercer University. Women currently represent about 23% of the engineering faculty, which is well above the national average of around 10%; yet out of six departments two have none and two have only one female representative each. Since the 1990s, the national average of female engineering students has been relatively stable and is approximately 20% of the engineering student population; freshmen enrollment at the Mercer University School of Engineering follows this trend. However, according to ASEE Prism Magazine, Mercer University School of Engineering is number three in the United States for awarding the highest percentage of engineering bachelor's degrees to women. This paper consists of statistical analysis of employment and enrollment data and information obtained from interviews and open discussions with students and faculty.

Our students come to Mercer University basically because of small size classes and broad range of scholarships, both academic and athletic. They are skilled in science and mathematics; however, they do not want to pursue their education in these fields due to perceived limited career choices. Following family tradition, active influence of high school teachers, and better job options were other often mentioned reasons for choosing engineering. Some additional reasons mentioned by female students include: engineering is the hardest major and she likes the challenge, engineering is easy according to the engineers in the family, Walt Disney Imagineering, physics and engineering seminars in high school, family members are engineers, and better engineering scholarship offer. Young women who survived the weed-out process are confident with their major choice. Both senior undergraduate and graduate students are comfortable working with male students and male only faculty.

Female faculty do not consider themselves discriminated against; they feel accepted and equal. However, as they have been exposed to male dominated environment since their science and engineering schoolwork, they are accustomed to being a minority and may not realize they are treated as the “weaker sex.” Female faculty are conscious that they may be treated differently than men because they are women.

Based on our research on gender issues in Mercer University School of Engineering we can boldly state that women, both students and faculty, feel accepted, equal, and accomplished; Mercer University again proved to be an excellent learning and working environment for both young people and professionals. However, that still can be improved by increasing the numbers of female engineering students.

A Successful "Women in Engineering Camp" for High School Students

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EXTENDED ABSTRACT

The Center for Integrative Natural Science and Mathematics (CINSAM) at Northern Kentucky University (NKU) has developed several successful summer engineering camps designed to target high school women and minorities in addition to the more traditional male enrollees. Success was measured by: the number of camp participants, supplying numerous, stimulating, relevant hands-on activities and an increase in student knowledge and career selection. Enrollment in the camps is facilitated by promoting the camps at Science and Pre-Engineering Information Nights (SPIN). The SPIN program was designed to give high school sophomores specific information about science and engineering, education and what it takes to succeed academically and to enter a career in a science, technology, engineering and mathematics (STEM) field. Local high school STEM teachers were asked to identify high ability students. Letters were sent to these student's parents inviting them and their "budding scientist or engineer" to an evening presentation at NKU. A fast passed informative talk on what it means to be a scientist or engineer, what courses to take in the last years for high school for proper college preparation, as well as the career opportunities available was given. After the presentation, attendees were taken for tours of NKU's science laboratories and to meet with NKU students.

A SPIN information packet was distributed, including forms for enrolling in CINSAM summer camps. The high school participants were given the option to enroll in a co-ed or female-only camp. This recruitment technique resulted in an enrollment of twenty-five students. The first year the camp was offered, prior to the first SPIN event, the camp was canceled for lack of enrollment. Two years after the first SPIN event enrolment was increased with the female's camp populated with 12 students and the second camp by 11 males and 2 females.

The camp curriculum was centered on hands-on activities including: materials selection and characterization, robotic construction, rapid prototyping, welding, CNC machining, physics activities and project management, as well as trips to local engineering firms and manufacturing facilities. Hands-on activities were conducted by NKU faculty and the trips to local engineering firms concentrated on discipline related activities. Trips to manufacturing facilities such as the Ford Assembly Plant were led by women engineers.

The majority of students indicated an overall satisfaction with the quality of the activities offered. A few indicated no change was necessary in the camp program, while most asked for a reduction in the lectures and an increase in the number of hands-on activities. Students' favorite activities included trips, welding, project management and robotic construction. All students indicated that the information and hands-on activities helped them in their career choice.

Applying the Key Findings of the EWEP Needs Assessment Final Report to a Single-Gender Outreach Program

Robert W. Hewitt, Thomas E. Banning

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EXTENDED ABSTRACT

In 2005 the Extraordinary Women Engineers Project (EWEP), a coalition of engineering associations, the American Association of Engineering Societies (AAES), the American Society of Civil Engineers (ASCE), and WGBH Educational Foundation published the findings of a research study examining the following question: "Why are academically prepared girls not considering or enrolling in engineering degree programs?" In their report, EWEP summarized seven key findings of this research which qualitatively answer questions related to how girls perceive engineering, and how their perception relates to their career choices. These seven findings can be effectively applied to the development and evaluation of an outreach program designed to stimulate interest in the engineering professions among high school girls. In 2007, the Herff College of Engineering at the University of Memphis hosted Girls in Manufacturing (GiM), a week-long summer outreach program which was designed to introduce high school girls to engineering in a way that emphasized their motivating influences. The program incorporated hands-on experiences, interaction with successful female engineers, tours of manufacturing facilities, and included a session that involved the girls' parents. The overriding goal of the program was to demonstrate to the girls that engineering can be a profession to which they, as creative and intelligent people, are uniquely suited. This paper applies the seven key findings of the EWEP Needs Assessment Final Report to evaluate the goals and activities of the GiM program.

A National Jobs Information Database: Implications for Outcomes Assessment

Robert A. Chin
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EXTENDED ABSTRACT

Data collected by Research Triangle Institute (RTI) for purposes of populating the Occupational Information Network (O*NET) database were examined for their potential to facilitate outcomes assessment. Selected data were identified from a summary report for a single engineering occupation—civil engineers—available from O*NET, the nation's primary source of information on jobs, and examined.

Included among the data collected by RTI are the (a) enduring characteristics that may influence both work performance and the capacity to acquire knowledge and skills required for effective work performance or what may be called worker characteristics; (b) descriptors referring to work-related attributes acquired and/or developed through experience and education or what may be called worker requirements; (c) requirements related to previous work activities and explicitly linked to certain types of work activities or what may be called experience requirements; (d) variables or other elements of selected or specific occupations or what may be called occupation-specific information; (e) variables that define and describe the general characteristics of occupations that may influence occupational requirements or what may be called labor market characteristics; and (f) a comprehensive set of variables or detailed elements that describe what various occupations require or what may be called occupational requirements.

The findings suggest that data collected by RTI on behalf of O*NET can at the very least serve as a valuable adjunct to any outcomes assessment program. In the long term and as instructional programs continue to adapt, evolve, mature, and improve, the data can come to serve as the primary source and the basis for conducting outcomes assessment.

Enhanced Project-based Learning Using Peer-Feedback

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EXTENDED ABSTRACT

We report on an innovative approach to teaching Optics to Engineering students in the form of an enhanced class experience developed by project-based learning, presentations, and peer-feedback. In order to compensate for the lack of laboratory work, an optics project was introduced alongside class demos. In order to increase class interest in the project, a competition was declared and the winner(s) were chosen by the class, who judged student presentations according to preset criteria. The winners received small prizes in recognition of their performance. The project was an important step forward in the learning process; it was very enjoyable for the class, in spite of the substantial additional work. We report on the successes and shortcomings of the project-based peer-evaluation method used in the classroom. The project presentations and competition created an effervescent atmosphere and debates, and increased student interest and participation.

Automation of Outcomes Based Assessment

Samir Khoury, Andrew Jackson, Merwan Mehta, and Leslie Pagliari
East Carolina University

EXTENDED ABSTRACT

Accrediting organizations require a degree program to have clearly stated outcomes and objectives. Required courses must have course objectives that are tied to program outcomes and objectives. This requires programs to have an evaluation system in place to help determine whether or not students are achieving the course objectives and eventually the program outcomes and objectives. Faculty members at East Carolina University (ECU) have collaborated on the development of an automated tracking and management system, which was deployed on a pilot basis by the various degree programs in the Technology Systems Department. The ultimate goal of this system is to allow faculty and administrators to manage and assess all the varied degree programs through a single database and provide a link between course objectives and program outcomes. In this paper, we provide an overview of the pilot assessment system that has been put in place at ECU in the Department of Technology Systems. To develop a deeper understanding of the prototype system, we discuss the basic system architecture, the manner in which it is being used to satisfy accreditation agencies, and the special reports that the system is capable of generating.

Assessment Database System (ADS) Development and Implementation

The assessment of a program involves the use of various sources of information. It is the authors' desire that the implemented system track course objectives that support program assessment within the Department of Technology Systems at ECU. An automated system, structured around an electronic database seems to serve this function very well. The authors believe that the final verdict on the efficacy of the system will not be available until the system has been in use for three to four years. By stressing the importance of on-going assessment and the need for an automated tracking tool such as the Assessment Database System (ADS) developed at ECU, we believe all faculty members will be more responsive to continuous process improvement activities across the curriculum. To that end, we have instituted a pilot assessment program using the new ADS-enhanced assessment tool. With six months of data now in the system - covering one full academic semester - we are confident that the program assessment process will meet our needs for the foreseeable future.

Assessment of program objectives through the evaluation of course objectives is only part of the overall assessment model. An additional step being analyzed is how ADS can be expanded to include assessment data from other sources and integrate them into the overall model. Some of these other sources include alumni and employer surveys, exit surveys of graduates, on-going student surveys, and informal feedback from students and alumni. With encouragement received from a team of recent National Association of Industrial Technology (NAIT) evaluators who witnessed the ADS in operation, we believe we are on the right track as we create a robust, centralized system to conduct an overall assessment for all of our academic programs.

A Comparison of Information Literacy of Freshmen and Seniors at VMI and UTC

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EXTENDED ABSTRACT

Information literacy can be defined as the ability to determine the necessary information to perform a task, to select the most appropriate sources, to efficiently acquire data, to recognize potential biases and conflicts of interest in data sources, to utilize data correctly, and to properly reference all items. Yet while a majority of engineering educators and professionals would agree that these are skills critical to the modern practice of engineering, they are not explicitly taught in many engineering education programs, and can be difficult to critically assess. As a first step in a study of information literacy of engineering students at our respective universities, the authors have developed a survey instrument to assess various aspects of this skill set, including student preferences in searching for information, awareness of potential indicators of source reliability, ability to conduct effective and efficient searches of electronic data bases, and proper citation of different types of references, as well as "fair use" and plagiarism issues. During fall semester 2007, these questionnaires were administered to freshman and senior engineering students at the Virginia Military Institute and the University of Tennessee at Chattanooga. In the presentation, results will be compared in terms of freshmen versus seniors, to assess improvement in information literacy as students move through the engineering curriculum, and students at VMI versus those at UTC, to see if trends are consistent in both universities. Future planned work includes expanding the surveyed universities to more completely represent the Southeastern Region of the ASEE, and to develop a more comprehensive assessment of information literacy among engineering students.

Due to the preliminary status of this study, this work is presented as an extended abstract and oral presentation only.

Evaluation of Viability of Alternative Energy Educational Programs in the United States

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EXTENDED ABSTRACT

Recently renewed public/media focus upon renewable/alternative energy sources and environmental and economic ramifications (due to media and political attention, increases in prices of petroleum-based products, and concerns about "global warming") has had a ripple effect upon higher education, and some colleges have begun to reinforce or add programs and research priorities related to biofuel, solar, wind, fuel cell, and other energy sources. Such programs can be found in programs ranging from engineering (electrical, mechanical, chemical, environmental, etc.), to the basic sciences (physics, chemistry, biology, etc.), to hybrid academic programs (environmental science, materials science, etc.), to specialized multidisciplinary graduate or research programs or groups.

Although justified from a perspective of long-term national benefit and security, such activity is not new. Similar activity occurred in the 1970s and early 1980s, but diminished over the next two decades as petroleum availability and prices stabilized, press coverage diminished, and government funding decreased. As then, such activity now tends to arise, in part, from the perceived immediate potential to attract students, publicity, and research dollars in this, once again, "glamour" field. It might be argued that some has been hastily instigated, without full attention to long-term viability, cost, and future changes. Furthermore, information in the media/press that drives some of this attention is not always optimally comprehensive and far-sighted, and can lead to skewing of broader realities. In some cases, it boils-down to asking the right questions about relevant issues. Needed is not only an objective evaluation of university programs dealing with alternative energy, but also development of optimal methodologies, metrics, and rubrics to assess such for both short-term and long-term viability, educational and economic effectiveness, and service to the university's "constituents" and "mission".

The authors will report on initial work with evaluation, categorization, and characterization of university-level alternative energy educational and research programs within the United States. Defining key questions to ask on questionnaires, and optimizing the categorization of such programs according to mission, constituency, pedagogy, research emphasis, and long-term survival and effectiveness is the first step. Subsequent questionnaire responses and information from catalogs, web sites, research/publication records, etc. will be analyzed, with appropriate metrics and rubrics, to form conclusions about challenges and opportunities within the field, and optimal paradigms: administrative, logistical, and pedagogical, for propelling such programs into the forefront of the nation's fitting quest for long-term energy independence, as public and press attention, and even government and industrial support, may tend to vacillate.

The Hidden Costs and Benefits of Part Time PhD Degrees

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EXTENDED ABSTRACT

Enrollment by US nationals in engineering Ph D programs has been steadily falling for many years. High salaries for recently qualified engineers working in industry compared to stipends for graduate students from scholarships and grants makes the cost of earning a Ph D through full time study on a university campus too high for many potential Ph D students. Since 2000, Virginia Tech has allowed students in selected locations to earn a Ph D through part time study while still employed full time. In 2003 the ECE Department at Virginia Tech introduced the Direct Ph D option, which allows students to complete their Ph D degrees without first completing a master's degree. Students complete the requirements for the MSEE degree but do not defend a thesis and can therefore use their thesis work towards Ph D research. This shortens the length of time required to earn a Ph D. These innovations have significantly increased the percentage of US Nationals in the ECE Ph D program, in contrast to the national trend of steadily declining enrollments. This paper calculates the hidden economic benefit of part time Ph D degrees, both to the student and to the university, and recommends a formula that assigns research credit to the faculty adviser for each part time student who graduates with the Ph D degree.

The cost to a potential ECE Ph D student of leaving full time employment in industry to spend three years in full time study is estimated at $116,100. The probability that this sum can be recovered in any reasonable time frame when the student returns to full time employment is small. This is a significant disincentive to potential Ph D candidates and is one reason for the declining interest in ECE Ph D programs. The cost to the economy of taking a young electrical engineer out of gainful employment for three years is estimated at $240,900, based on the loss of earnings, income tax revenue, and costs to the university. The part time Ph D allows the student to remain in full time employment and avoids the high cost to the individual and the economy.

In most research universities, productivity of the faculty is measured by research dollars earned and papers published in refereed journals. Part time Ph D students do not need research contracts since those costs are absorbed by their employer, and tend to publish fewer papers than full time Ph D students. Thus faculty have a disincentive to advise part time Ph D students, and those that do are penalized in the rewards process. A new accounting model is needed that allocates an in-kind contribution from the student's employer to the university's research income, and a similar sum to the faculty adviser.

Emphasizing Sustainability Principles in Developing Building Technology Courses: Engineering Educational and Research Collaboration between Egypt and USA

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EXTENDED ABSTRACT

The Egyptian Ministry of Higher Education has announced that an independent monitoring body would be created to oversee the accreditation of educational institutions to ensure they meet acceptable standards. In this regard and central to educational development philosophy should be the commitment to the architectural design excellence that demands not only skillful manipulation of form and function, but also inspiration from a broad body of sustainable building science and technology. In partnership research with the Department of Technology Systems, East Carolina University, in the USA, the study attempts to explore means of developing the Building Technology courses at both undergraduate and graduate levels in the Department of Architectural Engineering at Mansoura University in Egypt.

The study tackles the problem of inadequate awareness of the role that architectural technology education can play in qualifying graduates to work better for preserving the built environment with more sustainable practices. The context of this paper challenges the sustainable and basic advanced architectural competencies delivered to students through the course. The proposed development aims to work further as an interdepartmental project that brings together the faculty and students from other currently separate educational areas of engineering and science. It aims at providing a foundation for design exploration and communication, offering students new ways to access updated design techniques, model buildings, and environmental present ideas.

To achieve its goals, the methodical process of the study explores the appropriate mechanisms of surveying the updated employment requirements and defining the education/training potentials necessary to apply to curriculum reform; compares the current program specification to latest ABET criteria, fosters a mechanism of international partnership in technology education development programs, explores the potentials of emphasizing sustainability content in the course developing, and processes the findings and results into a project outline. The development criteria are recommended to help allocate competencies with emphasis on satisfying accreditation criteria in both the department and faculty educational programs and their measurement. Design theories as well as building construction, architectural design, and graduates' professional practice will benefit from the courses' development.

A Low Cost Environmental Test Chamber for Teaching Engineering and Technology Students

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EXTENDED ABSTRACT

Environmental test chambers are used in a variety of ways in supporting the development of new products and processes and can provide an excellent means to expose students to standardized testing procedures as well as offer opportunities to effectively supplement the teaching of control systems and instrumentation. Further, as pointed out by Taylor, environmental test chambers offer an ideal balance between cost and opportunities to solve real design problems in an educational setting [Taylor, 7]. This paper will focus on how environmental test chambers can be used to supplement Engineering Technology programs as well as focused information on how an environmental test chamber and associated control systems were developed through a project funded by the Department of Energy. As a result of the sponsored research, a new hybrid residential water heating device was developed that required the use of an environmental chamber for testing. Further, an environmental test chamber was developed for laboratory testing as well as supporting laboratory instruction in engineering technology programs. Using LabView™ for data acquisition and control, a relative low cost but effective chamber was developed by Western Carolina University and Asheville-Buncombe Technical Community College through a joint partnership. This paper will present a logical approach to developing such a system and describe how applications have been integrated into curricula at both the two-year and university level. Emphasis will be placed on environmental chamber system design and control methods and how the project was integrated into a valuable learning experience for two-year post secondary students, four-year university students, and graduate students in Engineering Technology. Educational merit and approaches will be described relative to respective educational levels.

A Multisite Case Study of Faculty and Teacher Perceptions of NCETE Professional Development Workshops on Engineering Design Content

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EXTENDED ABSTRACT

The purpose of this study was to describe a process of preparing technology education teachers to teach engineering design concepts in the context of technology education. This process was identified through a study of professional development activities that were organized and conducted by technology teacher education partner universities of the National Center for Engineering and Technology Education (NCETE) to prepare middle school and high school technology teachers to infuse engineering design, problem solving, content, and analytical skills into the K12 curriculum. A collective multisite case study formed the methodology for this study. Data were collected through individual interview sessions that lasted 30-40 minutes, video footage, observations and artifacts. A total of 15 interviews were individually analyzed, and then compared through a cross-case analysis, to look for emerging themes. Professional development
emerged as a core theme and comprised the following sub themes: planning, communities of practice, professional development administration and learning environment, professional development for technology education teachers, professional development activities in the classroom.

Identification of Quality Indicators of Visual-Based Learning Material in Technology Education Programs for Grades 7-12.

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EXTENDED ABSTRACT

The purpose of this study was to identify the quality indicators of visual-based learning material in technology education for grades 7-12. A three-round modified Delphi method was used to answer the following research questions: RQ1: What indicators should quality visual-based learning material in technology education have to be effective and efficient in transmitting information for grades 7-12? RQ2: What are the indicators of the learner's characteristics that impact the selection of visual-based learning material in technology education for grades 7-12? The quality indicators were determined by consensus reached by a panel of 21 educational experts randomly selected from participants in two NSF funded projects that piloted and field-tested visual learning material in technology education courses. The two funded projects were VisTE and TECH-Know. In the first round, the panel was provided with examples of quality indicators. The example indicators in the first round instrument derived from the literature review. The first round of the modified Delphi method used an open-ended questionnaire format in which the experts were asked to keep, reject, modify or add a new characteristic. The responses generated by the first round contributed to the development of the Round II instrument. In the second round, panelists were asked to value and rank from lowest to highest the items identified on Round I on a 5 point Likert scale.

In Round III the experts' panel was asked to accept or reject the quality indicators derived by the second round. Based on an analysis of data collected on Rounds I, II and III conclusions were drawn and 18 quality indicators were found.

Engineering Technology Explained in Math and Science --- A New Course

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EXTENDED ABSTRACT

The importance of mathematics and science will never be overemphasized in engineering and engineering technology education. The ability of mathematical analysis and physical understanding is considered a merit among engineers and technicians. However, major reports have been released by highly respected U.S. academic, scientific, and business organizations on the need to improve science and mathematics education. Although a great many of programs in engineering or engineering technology have strong curriculum requirements on math and science, it is perceptible that a gap exists between math/science education and engineering/technology education. In some cases, when a theory in math/science is taught, neither the students have ideas on nor the instructor will mention its particular applications into engineering/technology; similarly, when an engineering especially technology course is taught, the students or the instructor lack an advanced, analytical point of view. This is especially true in community colleges, one of whose objectives is to serve as a feeder to four-year universities.

A new teaching experience is presented in this paper. The author introduces purposefully more advanced analytical methods in his engineering technology curricula. The author integrates mathematical explanations and physical insights into technology courses such as analog communication systems, digital communications, and electric power generation, transmission, and distribution. This instruction improves the students' performance inside and outside of the classroom. Encouraged by responses from students, the author develops a new course, which serves as a technical elective, to present to the students the analytical methods. The paper describes how the course is developed and what content is included. Major questions that may be encountered during the educational practice are also discussed.

Interdisciplinary Research for Engineering Skills Development

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EXTENDED ABSTRACT

This work reports the results of an *ad hoc* interdisciplinary research experience for undergraduate engineering students at the Plasma Engineering Laboratory (PEL) of the Polytechnic University of Puerto Rico (PUPR). The strong features of this experience and their relationship with Accreditation Board for Engineering and Technology (ABET) outcomes are pointed out, and a qualitative description of the results is discussed, in terms of the performance of the students during the experience and after it. An example of the different activities performed by a team of undergraduate students, and their relationship with the ABET outcomes is presented. The undergraduate research at the PEL provides the students with a unique opportunity to practice engineering before graduation through real life problems, innovation, collaboration with other institutions, and presentation of their work for engineering and scientific audiences.

Industrial Research and the Academic Connection at a Regional University

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EXTENDED ABSTRACT

During the past decade, many industrial research laboratories have become in-house contract providers of technical services to company divisions. In many cases, lab emphasis has shifted from long-term strategic projects to immediate tactical problems. Decreasing budgets and staffing in industrial laboratories has had a number of impacts, not the least of which has been to increase the potential for industrial-university cooperation.

Development of university-industrial cooperation is a planned event in which a number of elements are essential. These elements include the existence of a faculty-industrial network, a university business attitude, and an up-front commitment to success by both partners.

Personal networking is essential because it provides a direct marketing method and point-of-contact between university faculty and industry personnel. It also provides potential partners with an opportunity to develop mutual trust. Without development of personal contacts and establishment of mutual trust, the industrial-university partnership won't develop.

The business attitude of both industry and the university is essential to a successful relationship. To a large extent, current industrial research involves short time lines and immediate problem solving. The university must recognize this constraint in faculty assignments, and it must develop a fair mechanism for evaluating proprietary industrial research when faculty members seek tenure or promotion.

A commitment by both parties to make the relationship work is facilitated if upper level university and industrial management are partners to, and supportive of, the arrangement. The university must be prepared to deal with industrial constraints on intellectual property, patents, and publications. At the same time, industry must recognize that university commitments of time and resources need to be compensated.

The industrial-academic partnership provides a mechanism in which both parties can achieve significant benefits. To realize these benefits, however, both industry and academia must expend the effort and commitment necessary to make the relationship happen.

Undergraduate Research Initiative

Roobik Gharabagi and Kyle Mitchell

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EXTENDED ABSTRACT

Undergraduate research experience has been established at the department of Electrical and Computer Engineering since August 2006. The goals of this initiative are to enhance undergraduate experiences through research collaborations with department faculty members, attract qualified undergraduate students to assist faculty with their research projects, increase research and scholarly activities within department, and encourage more students to attend graduate schools. The department has been providing funding from its general expense budget. In addition, faculty with external grants provided summer stipends to student researchers. Students with GPA of greater than 3.0 are encouraged to apply. Students are encouraged to meet with faculty mentors to discuss areas of research interests. Upon mutual agreement, and a recommendation from the faculty, a student is hired as research assistants. Students are typically expected to devote no more than ten hours to research activities during the academic year. Summer research activities are supported through faculty research grants. Summer appointments are full time. Students have also been able to find summer research positions at many universities across the United States with grants from NSF Research Experiences for Undergraduates (REU).
In primarily undergraduate programs such as the electrical and computer engineering at the Saint Louis University, the initiative has proven to be valuable in providing capable assistants to the department faculty members with their research and scholarly activities. It has also encouraged faculty to seek external funding knowing the availability of qualified assistants. The number of proposals by department faculty members seeking external funding has increased.

The size of the department and the duration of the initiative provide a small sample for assessment of the initiative. For the past two years the initiative has been able to provide funding for seven highly qualified students. Students involved with undergraduate research have shown improved academic performance and more interest in applying to graduate programs. Two of the seven students are applying for highly reputable graduate schools. In the previous years less than ten percent of our graduating students attend graduate or professional degree programs upon graduation.

Hence the initiative has been able to achieve its stated goals. The initial success will be leveraged to gain more support and funding both from internal and external sources. The electrical and computer engineering department is also engaged in activities to establish a five year BS-MS program.

An REU Experience on the Industrial Applications of Sensing, Modeling, and Control

Mohamed Abdelrahman and Sally Pardue

Tennessee Technological University

EXTENDED ABSTRACT

This paper describes a research experience for undergraduates (REU) program that focuses on multidisciplinary high-tech opportunities in the metal casting industry, resulting in a set of multidisciplinary research projects. Undergraduate students and mentors from electrical, mechanical, and chemical engineering and industrial technology are involved. We discuss the lessons learned and the challenges that we have faced in the recruitment and operation of the program during the first two years. We also discuss in detail the benefits and drawbacks of the unique model, Student as the Principal Investigator (SPI), utilized in our program. In this model, undergraduate students define their own research question within a given framework instead of following a plan defined for him/her by the mentor. Mentors were involved to a limited extent in defining and updating the research question while the students maintained ownership of the research. Although the model is generally positive, some issues arise in the implementation. Future plans for the 3rd year are also presented.

Fostering Undergraduate Engineering Research in a Public University

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EXTENDED ABSTRACT

There has been a considerable emphasis and support from major research agencies in the nation (NSF, NIH, NASA, DOD) to involve undergraduate students in science and engineering research and thereby increase the nation's capacity for research. In addition, the faculty, sponsoring organizations, and research foundations have recognized the benefits of engaging students in research early at the undergraduate level. The paper describes the author's recent experience with the undergraduate research of engineering students in a research-intensive Ivy League university. The following paragraphs describe in brief, the author's observations and thoughts about the undergraduate research at public and private institutions.

1. **Conditions for the Culture of Research:** 4-year colleges and programs that offer baccalaureate degrees in science and engineering often have notion that research is a distraction and takes away time from learning. It is noted that learning comes from conventional as well as active learning by students. The presence of graduate students on campus helps immensely and can help develop the culture of research, quickly. Undergraduates (UGs) emulate graduate students. In the absence of graduate programs, the UG researchers are to be encouraged by mentoring faculty by making presentations on current technologies merely to create interest for research in UGs. Faculty can also talk about their research pointing the obligation of an engineer and scientist to serve society through research.

2. **Requirements for Research:** The degree programs need to should consider requiring UGs to do research to meet their technical course requirements. It'll also be a requirement for faculty to mentor UGs in research. Presentations of current research by faculty in open forums, exhibition of attractive posters depicting design and research accomplishments by current and former students and faculty, posting of topics for research, frequent meetings with potential researchers will help promote research interest among students.

3. **Making Research Work**: Mentorship by faculty is a key to the success of undergraduate research. Participation in research should earn faculty a teaching credit and joint scholarly publications resulting from research should result in additional recognition. Faculty should engage students in laboratory work to begin with, and add an intellectual component to their work to challenge their thinking. Frequent meetings, careful guidance with encouraging spirit and arranging students to meet with accomplished researchers who are not necessarily in their chosen field of investigation often contribute to student interest in research.

4. **Research in Public and Private Institutions**: Flexibility in curriculum in private institutions provides latitude to introduce research at the UG level. In an Ivy League system, UG students are required to do 6-9 hours of research, one necessarily in liberal arts. Public institutions may not have that luxury but faculty who are the stewards of curriculum can make research mandatory for UG and make them aware of emerging fields. This will attract students from university-wide disciplines and help develop interdisciplinary research. Funds for research in private institutions are easily available. In public college a funding mechanism is to be developed to foster research.

5. Outcomes of Research: Through research at college level, students will--develop independent thinking, learn to plan research tasks and time schedules, develop confidence to come up with alternative way of doing things, gain skills necessary to complete analysis and experimental skills, develop written and presentation skills and mature to appreciate peers, and often pursue higher degrees in science and engineering.

STATISTICAL ANALYSIS OF LAW ENFORCEMENT SURVEILLANCE IMPACT ON SAMPLE CONSTRUCTION ZONES IN MISSISSIPPI (Part 1: DESCRIPTIVE)

Tulio Sulbaran and David Marchman
University of Southern Mississippi

EXTENDED ABSTRACT

It is estimated that every year over 1000 people are killed and over 40,000 people are injured nationwide in roadway construction zones. Construction zones have a higher number of crashes and therefore special measures are required to improve roadway safety conditions. Law enforcement surveillance is one of the special measurements taken by several departments of transportation throughout the United States to reduce the number of crashes in construction zones. However, there are a limited number of studies documenting the impact of law enforcement surveillance in construction zones in the nation.

This paper focuses on the descriptive statistical analysis that was performed to measure the impact of law enforcement surveillance in sample construction zones in Mississippi. More specifically, this paper includes statistical analyzes of traffic trends, crash information as well as characteristics of the studied area such as: a-Annual Daily Traffic Growth; b- Traffic Volume Variance; c- Hourly Distribution of the Traffic Volume and Vehicle Classification; d-Volume Hourly Peaks; e-Number of Citations; and f-Number of Crashes. The analysis presented in this paper can also be used to support case studies for class discussion and therefore build bridges to make connections between real data and educational experiences that facilitate engineering education.

The results presented in this paper reveal the importance of performing statistical analysis to calculate quantifiable objective measures to assess the impact of safety programs. Additionally, it emphasizes the importance of sharing real life data (obtained from applied research experiences) with students to facilitate meaningful learning experiences.

Development and Implementation of an Industry Accelerated Construction Management Capstone Course

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EXTENDED ABSTRACT

Construction capstone courses are developed to assist graduating students in understanding the realities of working in industry. Learning objectives are prepared to create activities that fully employ the knowledge gained and new technologies are introduced to ensure students maintain currency with the construction industry. This paper investigates historical Capstone courses and details development and implementation of a revised Capstone course structure that includes explanatory documentation on the use of two industry project management software platforms. Working with the McGraw-Hill Construction Project Network (MHC) and Information Handling Services (IHS), students are introduced to a variety of project documents that allows for enhanced analysis of selected assignment components. Outcome assessment results are discussed in conjunction with anticipated future course plans.

Creating Animated Multimedia Problem Solutions

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The Citadel

EXTENDED ABSTRACT

This paper describes an innovative approach to the development and presentation of solutions to undergraduate level engineering problems by using an animated and multimedia format. The educational material includes animated multimedia demonstrations, visual and audio description of the problem and solution, and documentation. It is specifically targeted at better understanding and comprehension of the solutions to engineering problems of undergraduate level Civil and Environmental Engineering courses. Course material and problem solutions do not have to be monotonous black and white text and graphs. Instead they should have attention grabbing animated pictures together with attractive and imaginable background designs and colors to captivate the fascination of students. The goal is to devise effective, convenient, and just-in-time instructional methods and course material for consistent practical delivery and effective teaching. The highly effective learning medium would incorporate and motivate learning initiatives of students. Implementation of the new concept course material would support timely and continuous learning skills while addressing the learning needs of students. The learning material can be used to deliver quantitative course material that will address and emphasize different viewpoints and topics of varying degree of difficulty. The material will enhance the learning and retention of engineering concepts. It would serve and function as on online electronic tutor for students when assistance is needed. It would also be used to demonstrate practical and real-world examples. All animated solutions will ultimately be delivered either as video files, interactive files, or as podcast videos. By keeping the material current and captivating, it enables educators to retain the attention span of students.

STATISTICAL ANALYSIS OF LAW ENFORCEMENT SURVEILLANCE IMPACT ON SAMPLE CONSTRUCTION ZONES IN MISSISSIPPI (Part 2: INFERENTIAL)

Tulio Sulbaran and David Marchman
University of Southern Mississippi

EXTENDED ABSTRACT

Every year several hundred people are killed and several thousand people are injured nationwide in roadway construction zones. Construction zones are inherently more hazardous for drivers and workers than non-construction zones. Therefore, states DOTs are continuously implementing measurements to improve the safety of drivers and workers in construction zones. Law enforcement surveillance is one of the special measurements implemented in construction zones by several departments of transportation throughout the United States (U.S.) to reduce the number of crashes. Unfortunately across the U.S., there are limited numbers of statistical analyzes documenting the impact of law enforcement surveillance in construction zones.

This paper focuses on the inferential statistical analysis that was performed to measure the impact of law enforcement surveillance in sample construction zones in Mississippi. Six specific statistical analyses were established to determine if there was any correlation between the studied variables. The six analyses were as follows: Analysis 1 - Law Enforcement Presences Vs Number of Citations; Analysis 2 - Law Enforcement Over Time Vs Number of Citations; Analysis 3- Number of Citations per Week Vs Number of Crashes Per Week; Analysis 4- Distribution of Volume Vs Distribution of Crashes; Analysis 5- Time of The Day Vs Number of Crashes and Analysis 6- Law Enforcement Presences Vs Number of Crashes. The analyzes presented in this paper can also be used to support case studies for class discussion and therefore build bridges to make connections between real data and educational experiences that facilitate engineering education.

The results presented in this paper reveal the safety impact of law enforcement in construction zones. Additionally, it emphasizes the importance of sharing real life statistical analysis (obtained from applied research experiences) with students to facilitate meaningful learning experiences.

Impact of Metal Hangers on Landfills: Case Study

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EXTENDED ABSTRACT

Reduction of solid waste generation and disposal is a concern for local, state and national authorities around the world. The 1990 Georgia Comprehensive Solid Management Act established a statewide goal of 25% solid waste reduction by 1996. This study was conducted with undergraduate students to evaluate the impact of disposing metal hangers on landfills in the Atlanta Metropolitan Area.

The impact was assessed based on the amount and the commercial value of the material disposed off on local landfills. The students developed two survey instruments; one was given to dry cleaning customer or potential customers, while the other was given to owner/managers of dry cleaning services. The customer survey instrument was designed to obtain information regarding the number and type of garments cleaned per customer visit, number of visits per month, as well as the fate or disposal method of metal hanger used by customer.

This paper discusses the variation of metal hangers' utilization rate depending upon the type of garment. Results of this study indicate that the overall utilization rate is approximately 86 pieces per capita per year. Based on population projections for the Atlanta Metropolitan area and household income, it was estimated that approximately 123 million hangers per year are disposed on local landfills. These hangers contribute annually with 3,430 metric tons of refuse material to the local landfills, of which 81.7% is non-ferrous metals, 13.2% is cardboard, 4.7% paper and 0.4% paint and lacquer. This refuse material has an estimated annual cost of $4,200,000 dollars.

Using LEGO® Robotics for K-12 Engineering Outreach

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EXTENDED ABSTRACT

The LEGO® NXT robotics system is being used as a tool for engaging middle and high school students in brief, single-session workshops as a means of conveying opportunities in engineering education and as a "conversation starter" for pursuing STEM careers. The authors are beginning their second year of using the LEGO system in this context. During the spring 2006 semester, the authors presented this program at two high schools, a junior college, a "Women in Science and Technology" conference and hosted elementary school students from the Tupelo, MS area on the MSU campus. Anecdotally, students, teachers, and school administrators, alike, are very enthusiastic about the potential for this robotics system to significantly impact learning in their schools. Feedback from student participants and teachers was universally positive. The program objectives have grown beyond the initial focus of using this robotics system as a recruiting tool. A broader objective now focuses on obtaining funding to place these robotics kits in strategic schools throughout Mississippi. Through this effort, the authors seek to establish relationships with teachers, teaming with them to make curricular enhancements—incorporating (or strengthening) project-based learning as a means of preparing students for pursuing STEM majors and ultimately STEM-related careers.

University Freshman Retention in North Carolina

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EXTENDED ABSTRACT

On the sixteen campuses of the University of North Carolina, student retention is becoming a strategically critical factor. For the period from 1998 to 2004, the University of North Carolina System had an average campus freshman retention rate of 80.1%. Some campuses have lower average freshman retention rates than other campuses apparently due to the level of freshman high school preparation as reflected by SAT scores. A linear regression model to predict an expected campus freshman retention rate was produced using average campus SAT scores.

A Faculty's Approach to Retention

Claude Hargrove and Ronnie Rollins

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EXTENDED ABSTRACT

In the US and many other industrialized nations, far fewer females and minorities enter technical fields compared to majority populations. Research has revealed that unsupportive educational environments reinforced by obstructive societal norms and low expectations have often contributed to the lack of interest and involvement of these populations in Technology in the United States. This is seen in quality of education in predominately minority schools and in the low percentage of females and minorities in technical fields. This paper illustrates a department's approach in fostering an environment designed to increase the interest of young students, particularly women and minorities, in Technology. Quantitative and qualitative data collected during the series revealed that participants enhanced their understanding of the range of career opportunities in Technology and became aware of obstacles hindering gender and ethnic diversity in Technology fields.

Building Continuous Loop Learning Communities: An Engineering Outreach Case Study

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University of Kentucky

EXTENDED ABSTRACT

The authors of this paper report on an engineering outreach program, which seeks to incorporate the construct of learning communities on various levels as one method of STEM cultural change. The outreach program seeks to provide students with an introduction to engineering, faculty with an opportunity to design and test curriculum for both outreach and undergraduate education and a technology mechanism to design, deliver, share and assess outreach activities as part of integrated loop. Preliminary results of exit surveys and faculty from the pilot program are presented in this paper.

While there have been positive reactions from faculty and students, there will need to be significant work done to facilitate the administrative overhead that will be associated with linking K-12 instruction with undergraduate instruction. To facilitate material development, distribution and assessment online tools are being developed and beta tested. In addition to the evaluation data from the pilot the initial designs of one of the software tools is presented.

Advising Students with WebCT Vista: A Pilot Project

Andy Ju An Wang
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EXTENDED ABSTRACT

Advising is one of the most important services faculty can provide to our students. Good relationships established during the advising process benefit both students and advisers. However, current advising practice is by and large ad hoc without standard guidelines and it lacks tool support. In this paper, we describe a pilot project of academic advising using WebCT Vista, aiming at a systematic way to advise students in the development of meaningful educational plans and achievement of personal and educational goals. Our faculty and students have been using WebCT for many years as a teaching tool. It is relatively straightforward to extend it into an advising tool as both faculty and students are familiar with WebCT's interface and its major functions. There are a number of challenges, however, in utilizing WebCT Vista in academic advising, to name just a few in the following: How do we combine online advising and face-to-face advising? How do we protect students' privacy using online tool like WebCT Vista? Are there any legal obligations and technical limitations involved in online advising? How do we evaluate and assess the effectiveness of web-based advising? Here in this paper, we present a preliminary result of our pilot project called "AWT", which stands for "Advising with Web Tools." AWT focuses on four areas of advising students: (1) Career Advising: This is a reusable component for career advising, including career choice and choice of academic major and minor based on interests, values, skills and abilities. We would like to document knowledge, skills, and accomplishments resulting from formal education, work experience, community service and volunteer experiences, making the connections between classroom and out-of-classroom learning. (2) Intellectual Growth: This part is about academic majors and minors. Students and advisors will use this tool to understand the requirements of an academic degree, make a study plan or degree-completion plan. This component will also include tools to advise institutional policies and procedures, employ critical thinking in problem solving, demonstrate good understanding of a general education and express appreciation for literature, the fine arts, mathematics, sciences, and social sciences. (3) Leadership Development: This part of the tool is to advise effective communication and leadership development, including communicates personal and academic strengths and weaknesses that affect academic plans, articulating leadership philosophy or style, serving in a leadership position in student, community, or professional organizations; and (4) Social Responsibility and Productive Lifestyles: This part will help advisors and students to understand the requirements of the codes of conduct, understand and practice principles of academic integrity, social and legal standards or norms, etc.

The author will present our project objectives and expecting outcomes, as well project status and progress. Challenges and limitations of WebCT as an advising tool will also be reported.

Distance Learning in Engineering Technology at Western Carolina University: Celebrating Success and Looking Toward the Future

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EXTENDED ABSTRACT

Distance education for engineering technology programs continue to face challenges in providing quality instruction equitable to resident programs. Western Carolina University has sought to insure the delivery of quality instruction by taking the programs on-site to regional community colleges. This paper will provide a brief historical overview of the evolution and delivery of technology based programs at Western Carolina University. Program curricula will be presented along with a description of articulation approaches with regional community colleges.

The off-campus Engineering Technology program has been successful and students continue to take advantage of offerings at distance locations. The potential for new students remains high in all areas of Western North Carolina. Continued success of the program hinges upon articulation and transfer of the student's 2-year degree, as well as the method of delivery. Current students also indicate a high degree of satisfaction in the quality of the instructors and the program as a whole, and a common reason given for satisfaction is the face-to-face delivery of Western's curriculum. Advantages and disadvantages of this direct delivery approach will be discussed.

The program has recognized considerable growth, and the outlook for continued expansion appears strong. While growth is indicative of success, it also presents challenges. These challenges include growing need for classroom and laboratory space, increased advising loads for faculty, and differences in traditional and non-traditional students. Approaches taken by Western Carolina University in regard to challenges and opportunities in these areas will be presented, and plans for future directions in distance delivery of engineering technology programs will be discussed.

A Comparison of Exam Scores Between Fully Online and Lecture Supplement Sections

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EXTENDED ABSTRACT

At the University of Southern Mississippi, online courses have become more prevalent and more accepted by students and faculty. The author instructed Statics and Strength of Materials during the Fall of 2006 and Spring of 2007 as Fully Online and Lecture Supplement sections. The Lecture Supplement sections utilized the same online material as the Fully Online sections but with optional meetings of face-to-face instruction. The self-paced (asynchronous) online material consisted of: (1) information on being successful in online courses including goal setting and time management, (2) recorded audio and sequential images of past in-class lectures including worked problems, (3) weekly assignments including websites showing presentations of the topic, worked problems, video, and applications of the assigned material, (4) On site photographs illustrating the topic. This instructor was interested in whether the exam scores were higher in the Lecture Supplement section than in the Fully Online section of the same course. The raw exam scores of the two courses were evaluated using a two-tailed t-test. The t-test determines the probability that the means of two data sets are significantly different. A difference in the means of the exam scores is considered to be caused by the advantage of the optional face-to-face lecture sessions for the Lecture Supplement students.

Mid term and Final exams were taken by Statics and Strength of Materials students during the Fall of 2006 and the Spring of 2007. The hypothesis tested was as follows: The means of the Lecture Supplement exam scores are not significantly different from the means of the Fully Online exam scores at the p=.05 level. Four data sets were evaluated; (1) Statics mid term exam, (2) Statics final exam, (3) Strength of Materials mid term exam, and (4) Strength of Materials final exam. Microsoft's Excel spreadsheet was used to calculate the means of the exam scores and the t-test probabilities. A probability of less than .05 indicates that there is a significant difference between the means of the Lecture Supplement and Fully Online exam scores that cannot be attributed to chance.

All of the t-test probabilities (0.426, 0.951, 0.458, and 0.323) are above the .05 level indicating that there is no significant difference between the means of the Lecture Supplement and fully online exam scores. The hypothesis that the means of the Lecture Supplement sections are not significantly different from the means of the Fully Online sections at the p=.05 level must be accepted. The practical result is that addition of optional face-to-face instruction to a Fully Online course does not significantly improve exam scores.

Integrating LabVIEW® into Engineering Technology Curricula

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Extended Abstract

In the current global economy, time to market is more critical than anytime in history. Narrowing the time gap between design, prototyping, testing and production is an increasing challenge that engineers and scientists will continue to face. Today's economy has driven a heavy dependence on advanced computers and software. Students in engineering and technology must master the skills demanded by their field, as well as the associated computers and software. One software package that has provided the ability to merge the virtual and real worlds has been LabVIEW® by National Instruments. This paper describes how LabVIEW® is being integrated into the Engineering Technology (ET) and Electrical and Computer Engineering Technology (ECET) curricula at Western Carolina University in an attempt to address some of the challenges facing its graduates. Background objectives are presented along with descriptions and examples of activities for courses in automated systems, instrumentation, and engineering analysis at the undergraduate level along with implementation for a graduate level automation course. Background objectives are presented along with descriptions and examples of learning modules and applications. Instructional methods, student performance, and educational merit are also presented.

Positive results of the applied approach have been observed through student feedback and performance, and integrated projects have provided a vehicle for transferring theoretical knowledge to practical, systematic application. This practical approach has resulted in improved collaboration among students from various disciplines and has provided more continuity within the ET and ECET curricula at Western Carolina University. Ongoing program assessment will continue to provide feedback on the effectiveness of the methods implemented with the goal of continued class improvement.

2007 Packaging Summer Programs at Christian Brothers University

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EXTENDED ABSTRACT

Christian Brothers University (CBU) is one of 12 packaging programs in the United States. CBU started its packaging program with an elective course in spring 2001. Currently, it offers an undergraduate packaging certificate, a B.S. in engineering management with a packaging concentration, and an M.S. in engineering management with a packaging concentration. Most high school students have never considered packaging engineering as a career. Consequently, CBU has hosted packaging summer programs during the last four summers with support from the International Paper Foundation, Medtronic Foundation, and International Corrugated Packaging Foundation (ICPF). This paper describes two successful one-week summer programs hosted by CBU and funded by ICPF in June 2007: Introduction to Packaging Engineering and Introduction to Corrugated Packaging. In addition to the summer programs, ICPF also funded an after-school packaging workshop for high school students in November 2007. This paper also describes the workshop activities.

The goal of the Introduction to Packaging Engineering was to introduce students to packaging engineering. Twenty-eight students from 21 schools attended the program from June 18-22, 2007. Sessions included basic mechanics/structures, packaging industry/opportunities, test methods, distribution environment/hazards, process control, recycling, ecosystem, college application process/financial aid. Two hands-on projects were egg cushioning and balsa crate construction. Four field trips took students to Pratt Industries (corrugated packaging), Schering-Plough (distribution packaging), Bryce Corporation (flexible packaging), and Medtronic (medical-device packaging).

The goal of the Introduction to Corrugated Packaging was to introduce students to corrugated packaging. Twenty-six students from 20 schools attended the program from June 25-29, 2007. Sessions were paperboard, corrugated fiberboard, container design software, container testing, and materials. Lab demonstrations and hands-on activities were key components of the program. Four field trips were arranged: Buckeyes (paper pulps), Weyerhaeuser (box design/manufacture), FedEx (container testing), and Wurzburg (supplies and applications).

An after-school corrugated packaging workshop was offered on November 6, 2007. Sixty-two students registered for this hands-on workshop, which could handle only 30 students. At the time of writing, another workshop was scheduled for January 24, 2008. Students designed boxes using CAD software, cut the boxes using a sample table, then went through a series of tests on their boxes. The program ended with a career session with panelists from local packaging industry.

A Course in Particle and Crystallization Technology

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EXTENDED ABSTRACT

The traditional chemical engineering curriculum is based on vapor-liquid processes with little discussion of processes involving solids. In typical courses attributes such as temperature, pressure, and composition are emphasized, while attributes such as particle size are omitted. For solids, however, product quality often depends on the particle size. Industry has stated that they need more engineers with training in particle technology. In spite of this, few U.S. chemical engineering departments offer courses in particle technology.

In response to this, a new split-level elective course in Particle and Crystallization Technology (PACT) was developed. This survey course, first offered during the Spring 2007 semester, was a blend of theory and practical applications where the applications emphasized both unit operations and the interaction of operations in solids processing. This course differed from many particle technology courses due to its emphasis on crystallization as a particle formation process.

The motivation and goals of the course are presented before giving a brief overview of course topics. In addition, the students' perception of the course and future developments are discussed.

Developing Elective Courses on Nuclear Energy

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EXTENDED ABSTRACT

With energy demands rising and climate change escalating, one of the few available means of producing large amounts of energy without greenhouse gas emission is nuclear, a technology that has been dismissed in the past thirty years for safety and environmental concerns. North Carolina A&T State University has recently received a nuclear education grant from NRC (Nuclear Regulatory Commission) to develop course modules and elective courses on nuclear energy to raise awareness of nuclear power and its related issues in security, safety, and nuclear environmental protection.

Course modules are developed to supplement a required freshman engineering course GEEN 100 Introduction to Engineering. The modules give an overview of nuclear engineering to students to broaden their career options. Two new elective courses are being developed. An engineering elective is for engineering seniors on nuclear energy and nuclear engineering. Another elective is for all majors, and it will focus on a secure energy future, covering nuclear energy among other alternatives. Topics will include: introduction to nuclear engineering, atomic and nuclear physics, fission, nuclear reactors and power plants, nuclear fuels and waste handling, safety and security.

The course modules and elective courses are intended to engage students and to stimulate their interests in this field to broaden the participation in nuclear engineering. The curriculum will build capacity in both faculty and students in a university without a nuclear engineering program. Even though only a limited number of students are expected to enter the nuclear engineering field, a heightened awareness of nuclear power by a larger portion of the population benefits all.

Multidisciplinary Teams for Engineering in Food Safety Applications – Bridges between Engineering and Biology

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EXTENDED ABSTRACT

The issues in complex engineering problems are rarely contained within a single academic discipline, so multidisciplinary teams are typically required. Along with differences in expertise and experience come differences in perspective and priorities, which enhance the team's capabilities but can also limit the effective operation of the team. Both the capabilities and limitations are enhanced as the differences in academic background among team members increase. Teams addressing problems with diverse technical aspects require extra efforts for effective communication, coordination and cooperation among team members. One example of the need for such diverse multidisciplinary teams is the design of engineered products for biological applications, such as equipment for food processing, because biological issues are added to the general engineering requirements. The specific application addressed in this project is equipment for cleaning pipes used in poultry processing plants.

The multidisciplinary team assembled in this project team consisted of students from mechanical engineering and from poultry science. The mechanical engineering students were involved in the project as part of their senior design course sequence, whereas the poultry science students were hired as part-time researchers. The team designed, built and tested a cleaning device that performed similarly to cleaning procedures typically used in the poultry processing industry. The successful accomplishment of the technical objectives of the project required a combination of knowledge and skills that none of the individual members possessed. Although the team members of one discipline may have relied on the members of the other discipline to accomplish tasks outside their skill-sets, they did need to stretch outside their comfort zones and learn about the other discipline. The mechanical engineers were not able to perform the microbiological analysis, but they did need to learn about methods for sanitization (e.g. temperature requirements) and deal with use of components approved for use with food products. Similarly, the poultry science members did not build or design the test apparatus, but in responding to questions from the mechanical engineering students designing the systems were exposed to the practical constraints in the design and fabrication of engineering systems.

In summary, a multidisciplinary team of engineering and biological science students successfully designed, fabricated and tested a device for clean-in-place cleaning of stainless steel pipes in a poultry processing plant. The project provided valuable experience for the students in learning about another discipline and working with individuals from that discipline.

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NSF REU Site: Chemistry / Chemical Engineering: The Bonds Between Us - A Three Year Retrospective

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EXTENDED ABSTRACT

The National Science Foundation (NSF) has an ongoing program known as a Research Experiences for Undergraduates (REU) whose goal is to support active research participation by undergraduate students with the long-term impact of encouraging students (particularly those traditionally underrepresented in science and engineering) to pursue advanced degrees. One key attribute of such a program is that the REU projects involve students in meaningful individual research projects as well as professional development training. Involvement of participants from diverse schools across the country (especially primarily undergraduate institutions) as well as inclusion of an international component helps broadens REU Participant perspectives and increases the breadth of student training. The research theme of REU Sites is open to any research area that NSF currently funds.

Three years ago, two brand new assistant professors successfully earned funding from NSF for a REU site at Mississippi State University. In the time that the "Chemistry / Chemical Engineering: The Bonds Between Us" program ran, much was learned about how to organize for a ten week intensive research program, how to ensure each student had a meaningful, positive experience, how to promote camaraderie among participants, and how to streamline participant logistics. The Bonds Between Us program strove to combine the research strengths of the chemistry and chemical engineering disciplines in a synergistic relationship. Participants gained experience, techniques, and perspectives in the chemical sciences that illustrated how chemists and chemical engineers approach similar research challenges from different perspectives. Participants benefited from close mentoring relationships with graduate students and faculty. Professional development and research skills training was interspersed with laboratory research, site visits of chemical plants and national research labs, social activities, interactive workshops in diversity and research ethics, and an end-summer symposium. At the conclusion of the summer, students presented at a campus-wide symposium with the option of submitting an abstract to present at regional meetings.

In this contribution, a description of the program and its goals will be discussed such that it could benefit anyone considering developing an REU program. Experiential guidance will be provided on structuring projects so that student learning and productivity is maximized. Further, organized professional development activities will be outlined in addition to a summary of structured social activities that build trust, teamwork, and camaraderie. Qualitative evaluation of activities is included so that others can improve upon the techniques used at Mississippi State University.

Assessing Student Preparation for Senior Capstone Design Projects

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EXTENDED ABSTRACT

Virtually every engineering program has some form of senior design project course. Ideally, the students' path to this capstone course prepares them for what will be required. At the University of Arkansas, we have a two semester, four credit hour, Creative Project sequence which serves as our capstone course. Students take 1 hour in the first semester where they select and analyze their problem, and then formulate multiple design choices to solve it. Based on their analysis of each design, they end the semester by choosing the one they will pursue in the second semester, 3 credit hour course. It has been assumed that during their three or four preceding years, students have been prepared for this capstone design project. To assess their preparedness, all Creative Project students were surveyed. Thirty entering seniors were asked five questions. The first questions asked how often students were exposed to design problems so far. The second question asked when they were first aware of the requirements of the senior capstone project. The third and fourth question explored whether students would benefit from partnering with freshman on their design projects both as freshman and as seniors. The last question asked the seniors which type of design project most interested them.

One of the findings is that the majority of students said that they were either only exposed to design/hands-on projects in their senior year, or in just a handful of previous classes. This is in contrast to their perception upon entering the university where they thought most classes would involve such design work. In addition, a strong majority of students said they only became aware of what would be required in this Creative Project course either in the course itself, or the year before. Lastly, a strong majority responded that they would have greatly benefited from involvement with this course while they were freshman. However, interestingly, most did not think that involving freshman with their current projects would be very beneficial. At the University of Arkansas, we believe these data indicate a need to include more design problems in our curriculum, beginning with the freshman year. In addition, we want to involve the freshman so that they better understand where their educational training is leading them. With time, we believe this involvement should include the sophomores and juniors. Such changes are consistent with what other programs are either already doing or considering implementing, though the specific details vary.

A Capstone Design Course in Fluid Thermal Systems

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EXTENDED ABSTRACT

"Design of Fluid Thermal Systems" is a senior-level, capstone design course at the University of Memphis. The course is set up for seniors in engineering who intend to practice fluid/thermal design. Fluid mechanics is a prerequisite, and heat transfer is a corequisite. The course includes topics such as design of piping systems, economics of pipe size selection for least annual cost, pump sizing and selection, system curves and operating points, heat exchanger sizing and selection. These topics integrate coursework in different subfields including material science, fluid mechanics, heat transfer, thermodynamics, economics and engineering graphics.

Examples of fluid/thermal systems all contain some common elements. A fluid is moved by a prime mover through a piping system in which heat transfer may be taking place. Therefore piping systems, pumps, fans, heat exchangers and associated equipment are relevant to a study of fluid/thermal systems. As such, the course material is divided into two major sections. The first is on piping systems blended together with economics of pipe size selection and the sizing of pumps for piping systems. The second is on heat exchangers or, more generally, devices available for the exchange of heat between two process streams.

Where appropriate, students are required to participate in something entitled "Show and Tell." Students are required to provide very brief presentations on selected topics. For example, one Show and Tell requires the student to give a presentation on various types of valves that are commonly used. The valves that are available are brought to class and taken apart (or cut in half prior to class) to illustrate how each works. Another involves a description of the types of pumps that are available commercially. A third requires a description of the types of viscometers that are available. Each student has the opportunity of participating, and each student will get practice in making an oral presentation.

Students enrolled in this course are divided into groups of 3, 4 or 5 members who work together as a team on a design project. Design teams function like companies and as such, each group chooses a company name and designs a company logo. Students work in groups to complete semester-long projects. Each project has associated with it a project description which begins with a few introductory comments and concludes with several tasks that are to be completed. Each project has an estimate of the number of engineers required to finish it in the given school term. The students are responsible for deciding on which projects they would like to work. Student groups bid competitively on the projects; awarding of projects is done on a lowest bidder basis.

Project Based Introductory Materials Science Course

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EXTENDED ABSTRACT

Albany State University (ASU) conducts a transfer engineering program (2+2) with Georgia Institute of Technology that has started in 1986 with the establishment of Regents Engineering Transfer Program (RETP) for residents of Georgia. Primarily attended by African-American students from all over Georgia with limited financial resources and average academic standing, the Engineering program at ASU has provided a unique opportunity to gain access to Engineering studies at Georgia Tech by completing the first two years in a more supportive environment.

As is mostly the case, many of the major degree programs at Georgia Tech require an introductory level course in materials science either as a core or as an elective subject. In order to achieve a seamless transfer, ASU started offering "ENGR 2001 – Introduction to Engineering Materials" from spring 2004 semester thus becoming the first RETP institution to offer this course. The course is now considered equivalent to Georgia Tech's "MSE 2001 – Principles and Applications of Engineering Materials" and students completing the course are awarded transfer credit by Georgia Tech. One of the major objectives of the course is to gain an understanding of the phase change, microstructure, material properties and how materials can be "engineered" to achieve the desirable properties. Towards this end, an Axiovert metallurgical microscope with a color camera and heat treatment furnace were acquired from the funding obtained from the Department of Education. Since spring of 2006, the course also requires students to undergo participation in a team project to prepare 1045 steel specimens by grinding, polishing, etching to observe the microstructures. Students then obtain the brinell hardness number by conducting the hardness test in a Universal Testing Machine with a brinell hardness attachment. Next they conduct the heat treatment of their specimens and repeat all the previous steps thereby able to compare the properties and microstructure before and after the heat treatment. The project also requires submittal of individual reports describing the procedure, test results and conclusion drawn from them. The project accounts for 15% of the course grade and is conducted outside the allotted class time.

The experience gained from the project allow students to appreciate how material properties such as hardness is related to microstructure that itself is changed by phase change effected by heat treatment. The project may be extended in future to include measurement of other properties such as modulus and strength of the specimen.

Integrating Real World Situations into an Introductory Course in Engineering Materials

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EXTENDED ABSTRACT

Introduction to Engineering Materials is a course taken primarily by Mechanical Engineering students as a core requirement in their sophomore year. Civil and Electrical Engineering students take the course as an elective in their sophomore or junior years. The course is currently taught at Armstrong Atlantic State University using the traditional, in-class lecture-based model with assignments and written exams used as testing tools. The main objective of the course is to study the fundamentals of materials processing, materials structure, material properties and materials performance as well as the relationships between these concepts. Some of the specific topics covered are: atomic bonding, crystalline structures, dislocations, diffusion, phase diagrams, structural transformations, mechanical, electrical and thermal properties, materials selection and design.

Many students view this course as a collection of abstract concepts and terminology with little application in the real world. The extensive course syllabus provides little opportunity to demonstrate and study its relevance to real world situations. Hence, there exists a gap between the theoretical concepts taught in this course and their use in real world applications. This contributes to the challenge to maintain a high level of interest, enthusiasm and information retention among the students. This paper describes the introduction of projects and case studies into this course in order to build a bridge across the above-mentioned gap. These projects and case studies vary from the use of the materials selection and design process, the study of historical engineering disasters caused by material failure to problem solving and analysis for design and failure. Student surveys are used as assessment tools to determine the effectiveness of the projects. Assessment results provide evidence that students develop a better understanding and appreciation of concepts and improve their problem solving and critical thinking skills. In addition, they also learn the art of in-depth research and independent study, and develop soft skills such as professional communication and team working abilities.

The paper presents a brief description of the course under consideration, a detailed description of the projects and case studies introduced in the course, a summary of assessment results and conclusions of the authors' experiences.

Engineering Sourcing in the Global Economy: Interrelationship Between Math, Science and Pre-Engineering K-12 Education

Marcos Chu

International Council of Systems Engineering Midwest Gateway Chapter

EXTENDED ABSTRACT

As the world has become "flat" due to globalization, it is necessary for companies to be able to recruit and retain engineering talent not only from around the globe but also be able to identify talent before they become available in the workforce. Prospecting engineering talent is key for the success of the organization and ensuring the company is able to design, develop and maintain world class systems such as communications devices, transportation systems and complex national defense systems. It is necessary for enterprises to develop the framework in which allows the company to attract talent in the beginning of the "pipeline" by starting to engage with pre-engineering students at the middle school level. It is imperative for companies to develop engineering communities within the organization in which allows a seamless collaboration between academic, professional organizations and the enterprise to attract, develop and retain engineering talent: Engineering Affinity Groups.

Identifying local emerging engineering talent where the company operates it is not an simple challenge. It is not necessary not only to identify pre-engineering students that has a good grasp of the fundamental disciplines such as math and science but also those that have a vocation to become engineers that are ready to tackle multi-disciplinary projects that involve also people of different cultures around the world. The task of "sensing" for this emerging talent has been historically delegated to the company community relation departments in which might loosely collaborate with the human resources college hiring departments. The task of sensing for talent should involve also the employees, specially the engineering community within the organization. It is necessary for companies to create an environment in which would allow the interaction between engineers and pre-engineering students.

As the engineers of today work with classroom teachers to identify the engineers of tomorrow, it is necessary that the Industry assist schools districts to provide mobilizing after school programs that not only enable students to develop their leadership and technical skills but also allow them to develop short-term visions in which includes pursuing a higher education in engineering

The key is for enterprises to be able to attract, develop and retain a skilled engineering workforce which is organic in the sense the workforce is sensed , mobilized and operational locally but part of a system in which is global in reach. It is necessary for enterprises to develop the framework in which allows the company to attract talent in the beginning of the "pipeline" by starting to engage with pre-engineering students at the middle school level. It is imperative for companies to develop engineering communities within the organization in which allows a seamless collaboration between academic, professional organizations and the enterprise to attract, develop and retain engineering talent. The key to create the relationships with external organizations to be able to be effective in supporting a pre-engineering development strategy. Engineering Affinity groups provides the framework in which allows the formation of such groups. Affinity groups is a organization model that allows autonomous operation within the enterprise in which is coordinated and interdependent. It is a systems of systems that is clustered within the organization with the specific task of developing the engineering workforce, specially by been involved with the community at large in the development of pre-engineering students

Critical Thinking in Higher Education: A Strategy for Development

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EXTENDED ABSTRACT

The development of critical thinking skills at the undergraduate level challenges many educators. Helping students learn to think within their discipline is greatly facilitated when they possess basic and discipline-specific critical thinking skills. This paper presents a campus-wide research project being conducted at The Citadel to assess critical thinking skills among students, to develop interventions for critical thinking, and to monitor the impact of these interventions. The school took three years to establish a baseline of critical thinking skills for their first semester freshmen and second semester juniors using the well-recognized Cornell Critical Thinking Test. A framework for critical thinking developed through a collaboration of faculty members provides the schema to identify and categorize the interventions and assessment methods.

Preliminary baseline results indicate that Citadel cadets, to some extent, develop critical thinking skills during their four-year educational experience. The background material, baseline results, framework, and proposed interventions will be discussed.

The Importance of Writing Skill to the Engineering Student

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EXTENDED ABSTRACT

Each year, universities across this country grant thousands of undergraduates their engineering degrees in their chosen discipline. At some point, these talented, intelligent young men and women are expected to move into industry (or higher education) and display the skills and abilities in mathematics and the physical sciences they have worked so long to acquire. Despite numerous papers written and many presentations made throughout their college career, many of these people will not be able to communicate their engineering skill via written communication.

This article seeks to highlight the importance of writing skill in engineering education. Making use of recent literature with regard to the subject, and examples of less-than-adequate writing, the case will be made that some premium should be placed on writing skill as a means of better preparing students to function in today's working world.

Three Steps for Preventing Plagiarism

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EXTENDED ABSTRACT

Although the specter of plagiarism has long concerned engineering educators, it has arguably become an even more critical concern over the last ten to twenty years as engineering programs began to assert a major role in training their students to write and speak as professionals. The fact that faculty with backgrounds in English and communication have often spearheaded these efforts also means that the problem of plagiarism in engineering writing has come under more intense scrutiny than ever before, in part because topics like appropriate use of research material and documentation of sources are traditional areas of expertise for writing and speaking faculty rather than for engineering faculty. As part of this trend, the Bagley College of Engineering (BCoE) at Mississippi State University follows three specific steps to help prevent plagiarism in its students' writing:

1. We provide students with our own highly detailed information on what types of information do and do not need citing as well as how to paraphrase and quote appropriately (including numerous examples of what and what not to do).
2. We developed and require students to use our own documentation style (modeled on IEEE), the handout for which contains over 30 sample entries for a variety of source material in addition to basic guidelines on citation conventions.
3. We use Turnitin.com to screen every student paper that moves through our program; we begin this process with a primer/tutorial on Turnitin and its workings before students start submitting papers, and we allow students to see their Turnitin originality reports after submission so they can see what sorts of potential problems Turnitin has flagged.

Because our program provides students with substantive communication experiences at every stage of their careers – from writing workshops and grading assistance in freshman-level courses to senior design/technical writing co-requisites – BCoE students also encounter the three preemptive steps above at every stage of their careers. Thus, our methods for plagiarism prevention are truly becoming entrenched in the college-wide curriculum, a phenomenon that bodes well for our long-term efforts to ensure all student writing is accurate, professional, and ultimately ethical.

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Sense and Sensibility: The Case for the Nationwide Inclusion of Engineering in the K-12 Curriculum

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Extended Abstract

The competitive status of the United States is inextricably linked to innovation just as innovation is inseparable from science, technology, engineering, and mathematics. A nation is generally considered to be competitive and innovative if it can produce products, processes, and services of superior quality and/or lower costs than other nations. Competitiveness and innovation lead to economic growth and to higher standards of living; hence the interest on the part of nations in technological innovation and technical progress. To stay competitive and remain a world leader in innovation requires that the United States produce a 21st century workforce complete with requisite education, training, skills, and motivation. If we accept a priori that science, technology, engineering, and mathematics education are synonymous with and are crucial to competitiveness and innovation and that, in terms of innovation, mathematics, science, and engineering are interdependent, why are mathematics and science uniformly ubiquitous in the K-12 curriculum while engineering is conspicuously absent? We are passionate in our belief that the uniform addition of engineering to the K-12 curriculum will help ensure that the nation has "the right" 21st Century workforce. Furthermore, we believe that a nationwide effort, led by a coalition of engineering academics, practitioners, and societies is required to turn this goal into reality. However, accomplishing this goal necessitates, as we are reminded by the title of Jane Austen's timeless novel, Sense and Sensibility, a workable solution that seeks the "middle ground" between passion and reason. We begin our paper with a bit of history to help establish context. Next, we create the foundation for making our case by using the research and literature to make two essential points: Engineers are not scientists. Engineering exists separate from science, has its own specialized knowledge community apart from science, and it is largely responsible for many of the most significant advancements and improvements in the quality of our life. Our workable solution requires that K-12 education, nationwide, accommodate the inclusion of engineering as a stand alone curriculum and we offer three reasons to support our position: (1) workforce development, (2) stimulating interest in STEM (science, technology, engineering, and mathematics) courses and careers, and (3) creating a technologically literate society. We conclude with some thoughts on how this important goal can be accomplished.

Capstone Design Based Engineering Design Outcome Assessment

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EXTENDED ABSTRACT

With global competition and international collaborations, there is an ever growing demand for system integrators and interface designer. Proper allocation of system and interface requirements during top down design phase and consideration of other factors such as manufacturability, testability, reliability are critical to successful design and competitive products. ABET 2000 accreditation criteria requires engineering programs to demonstrate that each graduate meets at least the 'a' - 'k' outcomes specified in its Criterion 3. Programs are also required to demonstrate how students attain culminating design experience in their curriculum. This paper shows how the various program outcomes are achieved through ten issues reports, oral presentation of the capstone design to faculty and industry representatives, and assessment of capstone design project written reports during various phases of the two semester capstone design sequence. This paper describes in detail various phases of engineering design as defining requirements, constraints and consideration of other factors such as economics, ethics, reliability, testability , energy and weight, etc, preliminary design (top-down) involving allocation of requirements and constraints to various sub-systems, detailed design and integration (bottom-up), using synthesis, analysis, testing and evaluation leading to overall testing and assessment. It also describes how the required capstone experience in our program assures attainment, assessment and continuous improvement of many of the ABET Criterion 3 outcomes. The results of assessment of capstone design project reports, oral presentations and issues reports show continuous improvement in student outcomes in identified outcomes and provide a mechanism for assessing results of changes.

Turning a Weakness into a Strength: Addressing ABET Requirements for Outcomes Assessment

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EXTENDED ABSTRACT

The University of South Alabama Electrical and Computer Engineering (ECE) Department underwent a comprehensive review of undergraduate programs in Electrical Engineering and Computer Engineering by ABET's Engineering Accreditation Commission (EAC) in October of 2005. The Department's two programs were determined to have weaknesses in Criterion 3 that related to the measurement of student outcomes achievement. Constituent surveys were revised and an end-of-semester course report was revised to provide documentation that individual classroom assignments directly address ABET program outcomes. The system was implemented in Fall semester of 2005 and the data was provided to ABET in June of 2006. Based on the information provided, ABET rescinded the program weaknesses and awarded full six-year accreditation to both programs. This paper reviews the outcomes assessment requirements and how they were met without significantly increasing faculty workloads.

All engineering programs at the University of South Alabama (USA) were reviewed for re-accreditation during the general review conducted by ABET in October 2005. In the Electrical and Computer Engineering (ECE) Department, academic programs in computer engineering and in electrical engineering were evaluated and were both found to have weaknesses associated with Outcomes Assessment (Criterion 3). One problem identified by the reviewers was the reliance on subjective assessment tools, particularly the personal opinions of faculty members on the degree to which Criterion 3 was met for a particular course. Another problem identified was the lack of a clearly-defined procedure for addressing Criterion 3 deficiencies, including action thresholds and specific corrective actions.

At the time of the general review, USA was using thirteen outcome assessment tools for Criterion 3. End-of-semester surveys were used in every undergraduate course, which required students to rate the instructional material and the course instructor's performance for compliance with course outcomes. In addition, the instructor would rate the class as a whole for compliance with course outcomes using a survey form. There was no formal rubric for the rating process: the instructor relied on teaching experience and perception of class performance. The ABET reviewers had some problems with this strategy. In their draft statement, the ABET team noted that program outcomes for each course were identified and were mapped into Criterion 3 a-k required outcomes. There was, however, a shortcoming in that the assessment tools should be better tied to specific outcomes and should better indicate the degree to which the outcomes are achieved by the students at the time of graduation. A specific comment in the draft statement was that the only evidence of student achievement is the "Faculty Assessment of Class" form.

In response to the findings in the draft report, a number of refinements and changes were made to the assessment tools. The new tools were used to collect data during the Fall 2005 and Spring 2006 semesters, and the results were summarized in a response to the ABET draft statement. Based on this input, ABET rescinded the weaknesses in the electrical and the computer engineering programs and granted a full six-year accreditation, with the next scheduled review in 2012.

On Engineering Students' Algorithm Insight and Math Manipulation Abilities: A Review

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EXTENDED ABSTRACT

Deficiencies in algorithm insight and mathematics manipulation abilities in college students have been the focus of recent education initiatives because they may be critical factors in students' problem-solving development. This problem has been systematically studied by Redish and Tuminaro for Physics-major students, but has not yet been investigated for other science and engineering majors. The works of Redish et al. are discussed on their relevance to engineering education: they identified six different types of difficulties with assigning meaning to the mathematics in problem context; four of them apply to engineering problem solving. Their work on identifying the most common student problem-solving schemes is reviewed. This paper also discusses the work of the author and colleagues on the disconnection between the classic math teaching with "x and y" to the use of other variable names in engineering courses. Students lack adequate training on solving actual applied-math problems in context, because they largely use "formula pattern matching" instead of relating data and unknowns to implied concepts, and because they interpret data by relating it to symbols with which they are familiar. Initiatives (i.e., curricula and class content changes) and available teaching tools to overcome such deficiencies are reviewed, and recommendations for their use are made. It is concluded that there is a substantial body of knowledge that attempts to understand students' math manipulation abilities, but experiences on application of such knowledge in the classroom are scarce. The author believes that the knowledge reviewed can help develop teaching environments and interventions to more effectively teach some engineering subjects.

Engineering Outreach to Law Enforcement

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EXTENDED ABSTRACT

This paper describes an innovative classroom based program that offers life long learning activities to working professionals in the law enforcement community while simultaneously including students at the undergraduate and graduate levels in a digital forensics service, learning, and research. The program has been highly successful with involvement of 4 PhD students, more than a dozen Master's level students, and several undergraduates who are focusing on the computer security/digital forensics area of interest.

Computer crime is a rapidly growing problem today in the U.S. and the rest of the world. When law enforcement officers first started investigating computer crimes in the 1980's, any police officer with a general knowledge of computers could investigate the crimes. Criminals had not yet developed the level of sophistication in place today, and the size of any digital media used to store data, actually potential evidence, was relatively small, and did not require sophisticated tools to investigate. Today's computers with potentially hundreds of gigabytes of storage space, and the availability of fairly sophisticated programs on the internet to hide that data, has forced computer crime investigators to look for extensive training in understanding and exploiting this technology. Universities have also begun to take advantage of this trend.

At Mississippi State University, the Center for Computer Security Research, with the assistance of the Mississippi Attorney General's Office and others developed a digital forensics training program that provides no-cost training to law enforcement officers throughout the Southeast United States in subjects ranging from basic computer skills and introductory courses in cyber crime to very advanced commercial training in using the most sophisticated investigative and analysis software available. Law enforcement officers attend this training free of charge, but are also provided room and meals free of charge as well. The reception of this program has been overwhelming, resulting in over 1000 law enforcement officers from over 200 departments in 12 states taking advantage of the training.

Funding for this center is provided by the United States Department of Justice, and has not only supported the forensics training center, but has also helped to establish a one-of-a-kind Cyber Crime Fusion Center in Jackson, Mississippi, where law enforcement agents from Federal, State, and local law enforcement agencies work together to solve computer crimes. Additionally, the support has enabled Mississippi State University to build a world-class digital forensics laboratory that can be used by researchers, law enforcement agencies, and students alike to experiment with new technologies and support real criminal investigations. The university also benefited from this support by being able to build a digital forensics education program and modern labs for undergraduates and graduate students interested in pursuing digital forensics as a profession. This paper describes the center, as well as provides evidence of the proven value of such work for the university and the nation.

The New Flavors of Engineering

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EXTENDED ABSTRACT

Current new emerging disciplines in Engineering are found growing in our Universities. Southern Polytechnic State University has some of these new flavors with programs in Software Engineering, System Engineering, Construction Engineering, and Mechatronics Engineering. The curriculum for these programs is examined with emphasis on the consensus found in educating professional engineers. The cornerstones for these promising disciplines and their foundations of what we as educators viewed as relevant and current will be presented.

Software Engineering The first undergraduate program of its kind in Georgia, Software Engineering (SWE) appeals to students who like the challenge of designing software systems to specific requirements. The SWE program teaches students to systematically apply computer science and mathematical principles to software development, and to work in teams to deliver high-quality products -- all in preparation for the tasks and environments they will face as professional software engineers.

System Engineering Graduates of the Bachelor of Systems Engineering (BSSyE) program will understand the multidisciplinary fundamentals of engineering and possess strong team skills to solve complex problems that cross disciplinary boundaries. They will understand current technology, but also be creative thinkers and have the flexibility to change with technology. They will be able to create sustainable systems, to adapt to the new global context and be empowered for lifelong learning.

Construction Engineering Construction Engineering requires rigorous training in basic engineering principles along with the development of skills in the areas of planning and management of construction projects and the associated systems and resources. Graduates in the area of Construction Engineering will be required to master technical elements and to demonstrate particular competence in the areas of communication, fiscal management, and project control. The broad-based background is tailored to develop professionals who will be able to move between the technical and managerial aspects of construction projects and to serve in key leadership positions within the construction industry.

Mechatronics Engineering In this major, some topics from Mechanical and Electrical Engineering and Computer Science are combined to produce graduates who are able to work effectively in all aspects of robotics, automated manufacturing, and the design of mechanical devices with imbedded intelligence.

Student-Centered Online Courseware Development Using Adaptive Learning Environment

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EXTENDED ABSTRACT

Distance education and web-based learning tools are getting popular as these learning technologies eliminate the time and other constraints in in-class lectures. The students who enter college today have become accustomed to Web browsers. They access information, make purchases and exchange data on the World Wide Web. Therefore, learning through web-based environments has dramatically increased and is now increasingly influencing the nature of teaching and learning in electrical and computer engineering education. The traditional web-based technologies such as WebCT or BlackBoard only provide instructor-centered learning environment without taking the students' needs and performance into account. Furthermore, study showed a significant improvement in retention when students were initially provided with immediate feedback. However, since assignments performed outside classroom must wait for human evaluation and subsequent return to the learner, the traditional web-based technologies are still lack of immediate feedback to the students. This paper offers a generalized student-centered interactive education framework using adaptive learning technology. The framework is presented based on the Courseware Authoring and Packaging Environment (CAPE), and the experimental Learning Management System (eLMS) tools. The flexible framework is designed using modules to arrange and represent topics, competence levels and teaching alternatives. Without knowing the details about the adaptive learning tools, any educator can capture his or her course materials into the proposed framework through graphical change of the module's connectivity. Educators can easily modify this framework to fit their pedagogies and students' needs.

CAPE is a graphical modeling language, where iconic nodes represent authoring concepts, and edges represent various kinds of relationships among these concepts. The CAPE designs specify when, or under what circumstances, content elements are presented to a learner during the course of a learning experience. On the other hand eLMS is a web-based delivery platform that supports inter-operation using web services, both in conjunction with enacting courseware designs and in managing domain-specific objects, such as classes, users, and courseware. The heart of the eLMS platform is a model-based delivery engine that enacts learning designs authored with CAPE.

The hierarchical CAPE model for adaptive learning is implemented in the courseware model for the undergraduate embedded system design course. Four different levels are used in this model to manage the visual complexity, both intellectually and in terms of editing. The top level of the courseware model includes two granules that delivery the welcome information and course introduction through two HTML pages and two phases that contain the lower level models. One phase, Course Overview, is to provide students with the general information of the course, such as course objectives, structure, prerequisites, competencies, and acknowledge, so that they will have an overall vision of this course. The other phase, Modules, contains all the course materials. A condition element and an action element are used to provide adaptive sequencing of the delivery of the two phases. If this is the first time for the learner to use this courseware, the condition element will automatically direct him/her to the course overview phase. If the learner has read the course overview, the condition element will let him/her to select whether he/she would like to review the course overview again or go to the Modules phase. The overall course materials are grouped into six modules. The modules are combined both in sequential and in parallel approach. Students' knowledge about the module is assessed at the end of each module. Students are not allowed to progress to the next modules unless they successfully pass the previous module assessment. By using adaptive computer aided learning tools and proposed framework, student can obtain smooth delivery of the customized course materials and self assessment based on their performance. Students' retention will be significantly improved by immediate feedback to their self assessment. The proposed framework can also be integrated to WebCT and BlackBoard to enhance the efficiency of knowledge delivery. Furthermore, the proposed framework will not only enable the distance education, but also enable powerful possibilities for adaptive in-class instruction and activities outside the classroom.

Student Attitudes towards the Use of Graphical Programming Languages in an Introductory Engineering Course

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EXTENDED ABSTRACT

In the fall and spring of 2007 freshmen CS, CPE, and EE students, at Virginia Tech, had the unique experience of working with five or six programming languages, all within one year and all for the purpose of developing fundamental programming skills. One of those languages was purely educational in nature (Alice), three were traditional and text-based (C++, Java, and MATLAB™ script), but two were unique graphical languages (RAPTOR™ and LabVIEW™). This paper briefly describes how the graphical / visual nature of RAPTOR™ and LabVIEW™ provide students with a learning environment that supports visual learning styles, which is believed to be the preference of most engineering students, and which is supported by the theory of multiple intelligences. Similarly this paper briefly describes how the graphical / visual nature of RAPTOR™ and LabVIEW™ create a learning environment that correctly builds off of the students' existing prior knowledge while simultaneously helping them to develop skills needed in their future courses, and how that is supported by the philosophy of constructivism.

This paper then describes how a survey was developed to take advantage of this unique opportunity to measure first-year students' perceptions of relevance, general attitude, and recommendations for further use of each of these six programming languages. Unfortunately, the tragic events that occurred at Virginia Tech in April of 2007 greatly reduced the number of students who chose to participate in this survey, which unfortunately limited the potential conclusions and implications. Even with that unfortunate event, 86 students participated in the survey, thus making it possible to draw conclusions about the attitudes of those students concerning the use of graphical programming languages in their introductory engineering courses. Within that group of students, they perceived the graphical programming languages to be just as relevant as the traditional programming language. Similarly, their general attitudes towards the two language types were statistically identical, as was their willingness to recommend those languages for further use. Those students did, however, report higher perceived levels of educational gains from their use of the traditional, text-based languages than from their use of the graphical programming language, but that is consistent with the fact that these students spent approximately one semester studying the traditional languages and only a few weeks studying the graphical languages. The results of this survey imply that further use of graphical languages in introductory engineering courses at Virginia Tech would be beneficial. Unfortunately, the survey limitations caused by unequal exposure to the different types of programming languages and the tragic events that occurred at Virginia Tech in April 2007, require a follow-up study to confirm those implications.

STRUCTURING DATA FOR ANALYSIS OF LAW ENFORCEMENT SURVEILLANCE IMPACT ON CONSTRUCTION ZONES

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EXTENDED ABSTRACT

Some of the most important functions of state DOTs are maintenance and construction programs. However, during the construction period, there are temporary traffic disruptions, which increase the number of accidents with associated deaths and injures. Therefore, several states have taken a proactive role in implementing special measures in construction zones to reduce the number of accidents. An example of such measures is the increase of law enforcement surveillance in construction zones.

Although, the increase of law enforcement surveillance has been used by several state DOTs, there are a limited number of studies documenting its impact. There are many reasons for this limited numbers of studies. One of these reasons is the added analysis complexity is due to the fact that several agencies are involved in collecting and storing the data. Furthermore, each agency uses a different data structure to store and retrieve collected information and in many cases some of the necessary data is not collected at all.

This paper focuses on the process implemented to restructure and consolidate the data obtained from multiple agencies to be able to measure the impact of law enforcement surveillance in construction zones. The content of this report was later used as the foundation for statistical analysis. Furthermore, the experience obtained from this data restructuring and consolidation could be used as a set of case studies in the classroom to build bridges and make connections that facilitate engineering education. The results presented in this paper reveal the importance of inter-agency collaboration, the need to establish a common data structure to facilitate the exchange of information among agencies, and the importance of using real life applied research experiences for making the connections that facilitate engineering education.

An Effective Model for Course-level Continuous Improvement in an Electrical Engineering Technology Electronic Communications Course

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EXTENDED ABSTRACT

In this paper, we describe an effective model for course-level continuous improvement through incorporating computer simulations and other performance-based assignments for theory development and conceptual design in an undergraduate electrical engineering technology course in electronic communications. Several experiments used to reinforce student learning of communications theory and applications, including assignments on amplitude modulation, frequency modulation, demodulation, and power spectrum analyses were developed and pilot tested during the 2006-2007 academic year. In this paper, we emphasize three main issues for implementing course-level continuous improvement: course reorganization, which includes a discussion on why there was a need for course redesign and how it affects student performance; development of assessment tools, which describes the mechanisms used for course-level assessment including the use of a course-level outcomes form (CLO), a continuous improvement efforts form (CIE) and a student course outcome (SCO) evaluations form; and, finally, the implementation of the continuous improvement plan, which describes the results of the continuous improvement process during the piloted academic year.

As a result of the assessment documents used to evaluate student performance, instructional methods were developed, modified and incorporated into the course for continuous improvement during the current assessment cycle. Based on the learning areas of need, the following goals were achieved as a result of implementing the continuous improvement plan:

- The lecture time devoted to spectrum analysis increased by 25%. Lecture notes were also made available to students for further study.

- More assessment activities on Fourier and spectrum analyses were incorporated into the course. Students were assessed on their theoretical competencies and practical understanding in problem areas using appropriate assessment tools.

In conclusion, an effective model for course-level continuous improvement plan in an undergraduate electrical engineering technology program is presented in this paper. Several experiments used to reinforce student learning of communications theory were developed and pilot tested during the 2006-2007 academic year. Assessment results proved to be successful in achieving the stated goals and providing continuous improvement for student comprehension.

Proposed New Direction for Electrical Engineering Curricula: Inclusion of Instruction in Nanotechnology

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EXTENDED ABSTRACT

In this paper, we articulate some of the major problems that must be addressed when assimilating nanotechnology into an engineering curriculum. The advent of this technology signals a paradigm shift in the way in which engineering academics must prepare their students for challenges they face in the workplace following graduation. An in-house survey of the current status of nanotechnology education in 100 leading (4-year) US engineering programs is discussed and summarized graphically. From this particular survey it is evident that large majority of the leading US universities offer no graduate courses with the word nanotechnology, or the like, appearing in the course title. In terms of undergraduate instruction, the picture is even bleaker. Of the 100 leading institutions surveyed, only one offered an undergraduate course in this subject area. Detailed information relating to our survey, giving among other things, institutional names and course titles, would be presented at the conference.

We have also outlined the basis of a strategy for modified versions of traditional electrical engineering curricula that are designed to meet the enormous challenge to engineering education posed by the advent of nanotechnology. Like nanotechnology itself, we conclude that the problem may be addressed both by using 'top-down', (i.e. graduate-level introductory courses), or 'bottom-up', (i.e. freshman/sophomore elementary courses), approaches. Specific recommendations in regard to course material would be presented at the conference. Although the paper focuses specifically on examples drawn from the authors' own experiences with electrical engineering degree programs, the recommendations put forward can be applied to any of the major engineering disciplines.

Interactive Electrical Circuit Tutoring Tool – eTutor

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University of Central Florida

EXTENDED ABSTRACT

Current methods of educational delivery in the field of basic electrical circuits are highly dependent on theoretical, analytical and applied approaches. Such methods are almost entirely delivered face-to-face in classroom and lab settings with minimum or lack of individualized delivery or assessment practices. However, the increasing number of students with different learning styles makes it harder for students to grasp the basic circuit analysis concepts. In this paper, we introduce an interactive individualized electrical circuits tutoring (eTutor) tool that helps students individually learn key concepts in electrical circuits analysis methods. This tool guides the student through a step-by-step analysis of common electrical circuit problems. In each step, the tool prompts the student to enter a formula that best describes the current step in the analysis method. Then, it responds with a personalized feedback that is dependant on the user's formula. Through the feedback process, the tool targets all lexical and analytical errors in the user input. The tool compiles a list of errors and warnings messages that are reported back to the student. Trials and interactive elaboration on errors allow the student to understand better the targeted concept in circuit analysis. The modular and template based design for the tool allows adding and modifying key problems by the instructor. In this paper, we will discuss the basic design of the eTutor, and report on an assessment study on the effect of using the eTutor in the introductory circuit analysis class at University of Central Florida. The study shows promising results with clear performance improvement when eTutor was utilized and compare to students who didn't use the tool.

Agencies and the Data Provided to Assess Effectiveness of Rumble Stripes on Highway Safety

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EXTENDED ABSTRACT

Although traffic deaths are caused by an array of factors, in the United States more than half of all roadway fatalities are caused by roadway departures [FHWA 2006]. In 2003, there were 25,562 roadway departure fatalities, accounting for 55 percent of all roadway fatalities in the United States. Roadway departure includes run-off-the-road (ROR) and head-on fatalities. In 2003, more than 16,700 people died in ROR crashes (39 percent of all roadway fatalities), and head-on crashes represented 12 percent of all fatal crashes [FHWA 2006]. On average, one roadway departure fatality crash occurred every 23 minutes. An average of one roadway departure injury crash occurred every 43 seconds [FHWA 2006]. In short, roadway departures are a significant and serious problem in the United States.

MDOT through the Traffic Engineering Division is commitment to improve Mississippi highway safety. MDOT has invested valuable resources to implement a series of safety improvement programs such as the "Rumble Stripes" program. Despite MDOT's high commitment and efforts to improve highway safety, MDOT does not know the impact of the "Rumble Strip" program in reducing crashes. In other words, MDOT lacks quantifiable evidence that demonstrates the effectiveness of this program.

This paper presents an overview of the agencies involved in collecting the data need tot assess the impact of the Rumble Stripes on Highway Safety. Furthermore, this paper provides a description of data collected and its structure. Finally, the results of the lessons learns are presented. They could serve as the foundation for similar studies and/or case students to facilitate students learning through meaningful real world scenarios.

Using Interactive Virtual Instruments to Teach Spectral Analysis

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[1]University of Kentucky, [2]Murray State University

EXTENDED ABSTRACT

Spectral analysis, or Fourier analysis, is a very fundamental topic in experimentation courses in mechanical engineering programs. It deals with time-varying signals measured from various physical phenomena and involves concepts like waveforms, Fourier series, Fourier integrals, Fourier transform, sampling and aliasing, etc. The traditional method for teaching spectral analysis is mostly done by lecturing the mathematical developments of each concept with in-class quizzes, homework and separate laboratory exercises. While students may learn the mathematical procedures to compute simple waveforms, many do not fully understand how a complex spectral is generated and why a real-time, continuous signal may be distorted after data acquisition process.

We have integrated the interactive Labview simulations into the lectures to help students better understand the fundamental concepts in spectral analysis. We have moved the class from a traditional lecture room to an interactive television video (ITV) room that is fully equipped with computers. With the use of virtual instrument (VI) via Labview, students can not only learn the mathematical developments of various spectrums from the instructors but also have the opportunities to "build and play" with the spectrums. With this integrated approach, the students are involved in the teaching process. As a result, the learning outcomes are accomplished.

Low Cost, Low Space, Low Set-up Time Experiments for a Course in Numerical Methods

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EXTENDED ABSTRACT

One of the major and common themes during our graduating seniors exit interviews several years ago was that they would like more hands-on and more real-life applications in their mechanical engineering courses. In response to such requests, several lecture courses in our department have now incorporated experiments that include class demonstrations, collection of data in a laboratory, building of simple experiments, etc.

As part of this effort, we developed a set of five simple experiments that are now used regularly in the classroom to teach the course in Numerical Methods.

We developed experiments that

1. are low cost so that other universities can develop them with minimal material cost (some experiments need use of a university machine shop),
2. require low space so that they can be carried to the classroom or set up in the laboratory that has limited space,
3. need low set-up time so that nominal amount of classroom or laboratory time is used. This is especially important in the Numerical Methods course at USF where other educational components such as simulations, problem-centered approach, programming, and real-life project assignments are also incorporated.

Data obtained from experiments is assigned for analysis as homework or as in-class computer laboratory assignment. Comparison between experimental and numerical results is also made.

Implementing a Hybrid Introductory Engineering Graphics Course

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EXTENDED ABSTRACT

As engineering graphics educators, it is our responsibility to continually reflect on our methods of instruction. Are our current methods of instruction the most efficient for delivering the content? Is our instruction appropriate for multiple learning preferences? If we try new methods, are they just as effective as previous methods for improving spatial and sketching abilities in students? Are students able to apply our content to unique situations at the end of the course?

Over the last 10 years, faculty in the Graphic Communications Program at North Carolina State University have been investigating different methods for delivering online content. These methods include static web pages demonstrating CAD software, streaming video presentations of course content, and asynchronous assessments of textbook readings using course management tools. Ideally, these innovations can be tested and refined offline in a test bed prior to replication across multiple sections and hundreds of students. At the graduate level, one of the authors has been part of an online graduate certificate program for community college teachers funded in part by the National Science Foundation. Courses in the online certificate program include both asynchronous and synchronous online instruction using a variety of course management tools. One course in this online certificate program (Instructional Design in Technical and Technology Education) served as a test bed for developing undergraduate Graphic Communications curriculum materials. Based in part from these test bed findings, online content for an introductory engineering graphics course was developed using several popular instructional design models. During the summer of 2007, Graphic Communications faculty developed voiced-over content presentations, software demonstrations, and sketching examples as well as online assessments. In the fall of 2007 three hybrid sections were taught using this material. Faculty used a survey to get student feedback about their learning preferences and information about the order in which they navigated through the online content. Final exam data from the hybrid sections was also compared to the sections which were taught face-to-face. No significant differences existed between the hybrid and face-to-face sections.

This paper summarizes data from previous studies conducted at the undergraduate and graduate levels, discusses the implementation of a hybrid or blended introductory engineering graphics course implemented during the Fall 2007 semester, and summarizes preliminary data collected from the course related to asynchronous content and demonstration delivery.

Connecting Industry Experience with Classroom Instruction

Richard Kunz
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EXTENDED ABSTRACT

Students in traditional lecture-based engineering courses often have a difficult time making the connection between textbook problems and real-life engineering situations. Sometimes this connection is not made and cemented until subsequent laboratory-based courses are taken, or until a senior-year capstone project is experienced. This can be a significant obstacle for students who are visual learners, particularly in basic engineering courses, but it extends to more advanced courses as well. It is undoubtedly most pronounced in courses without a laboratory component. Introducing simple visual and tactile artifacts, as well as relevant anecdotes from engineering experience, goes a long way toward making the critical connection between theory and practice, motivating the students, and establishing a link in students' minds between engineering as a course of study and engineering as a career.

The author taught basic and advanced engineering mechanics for seven years immediately after the completion of graduate studies, followed by twenty years as a practicing engineer in the aerospace industry. In 2006, he returned to the classroom to find that, while the academic landscape has changed significantly in the intervening years, the needs of the students have not. The fundamentals of statics, solid mechanics, and structural analysis remain engraved in stone, and students still have difficulty connecting these fundamentals to why airplanes fly, and what engineers do to make that happen.

This paper discusses specific instances in which "hardware", "firmware", and "software" from aerospace practice have been introduced into traditional lectures in an attempt both to illustrate key points and to provide a grounding frame of reference. "Hardware" includes test specimens and small structural artifacts from actual aircraft to demonstrate specific concepts of load transfer; "firmware" includes excerpts from archival engineering reports showing that the techniques of structural analysis developed in class are used to verify and document flightworthiness; and "software" includes anecdotes addressing issues such as customer interaction, reporting and communication, and ethics.

Accreditation Changes in Civil Engineering Curricula: Addressing the Additional Science Requirement

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The Citadel

EXTENDED ABSTRACT

The Accreditation Board for Engineering and Technology (ABET) has promulgated criteria for accrediting engineering programs in the United States under the heading ***ABET Engineering Criteria 2000***. As part of ABET's *Criteria for Accrediting Programs in Engineering* in the United States, ABET has selected an approach of adopting program criteria for engineering disciplines that have been created by parent discipline specific organizations. Once approved by ABET, these program criteria are integrated as part of the accreditation process. One of these Participating Bodies of ABET is The American Society of Civil Engineers (ASCE) which has taken on the role of formulating program criteria specifically for programs specifically dealing with civil engineering.
As a result, ASCE has published the ***Civil Engineering Body of Knowledge for the 21st Century—Preparing the Civil Engineer for the Future***. This publication, which supports ***ABET's Engineering Criteria 2000***, has been referred to as the "Body of Knowledge" (BOK) by ASCE's Committee on Academic Prerequisites for Professional Practice. It describes what should be taught and learned, and incorporates the eleven "a" through "k" ABET outcomes while adding four additional ones addressing technical specialization, project management, construction, asset management, business and public policy and administration, and leadership. The BOK further delineates what level of competence a student is expected to achieve for each of the fifteen outcomes from either a Bachelor's Degree program plus a Master's Degree (or 30 hours plus experience) (**B+M/30**), additional experience, or additional post-licensure education and experience.

Effective with the 2008-2009 Accreditation Cycle, Civil Engineering programs must demonstrate that graduates are able to apply mathematics, physics, chemistry, and at least one additional area of science, consistent with the program educational objectives. The reasoning is that ASCE's BOK places increased emphasis on math and science, while recommending a broader background in science. Clearly this provision is intended to assure graduates are able to solve problems in at lease one additional area of science, while suggesting biology, ecology, geology/geomorphology, and geospatial representation as possible fields to consider. This paper examines how one institution studied various alternatives, formulated a plan to change the curriculum, and then adopted these curriculum modifications to satisfy this new science requirement.

Improvisation, Ingenuity and Design of Experiments to Reinforce the Civil Engineering Curriculum

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EXTENDED ABSTRACT

One very effective outreach activity and a staple of Engineer's week events is the Popsicle® stick bridge building contest targeted at K-12 students. Since first being offered in the 1960s, the contests have succinctly demonstrated basic engineering mechanics and efficiency concepts, such as the strength to weight ratio. Although the format varies, the bridges are typically loaded until failure and then judged by a combination of their performance, efficiency, and aesthetic design. Students are challenged to design and carefully construct their scale model bridges, exercise ingenuity, and enjoy the fun and thrill of competing with other students.

What is often overlooked in these contests is the improvisation and ingenuity that go into designing the contests themselves. A survey of past contests showed wide variation in the rules and means of testing the bridges, suggesting that the contests have been designed "organically". Despite this variation, the educational outcomes appear consistent A group of civil engineering undergraduate students at George Mason University was tasked with designing the rules, judging criteria, and testing apparatus for a bridge building contest in February 2007. Using only basic materials and a general notion of how other contests were run, they successfully designed and carried out the contest with 14 participants from local high schools. This paper will profile their experience specifically in the context of civil engineering curriculum design, ABET outcome achievement related to design of experiments, and the effect of organized student activities providing synthesis to the curriculum where it was never planned to occur. We discuss the role of students as mentors and as exemplars and the utility of improvisation for directed learning. Finally, we discuss how design of instruction theory can apply to engineering students at the peer level with approaches for measurement.

GIS Integration Across a Civil Engineering Curriculum

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EXTENDED ABSTRACT

One critical element of civil engineering is the ability to visualize the economic, social, environmental, and political consequences impact that design decisions will have. Geographic information systems (GIS) enable users to visualize some of these factors and are becoming a critical tool for the civil engineering design professional. In an effort to enhance students' learning experiences not only by actively engaging them in the learning process through a design-based approach, but by also providing the opportunity for students to become proficient in state-of-the art software applications typical in the civil engineering workplace, faculty in the Department of Civil Engineering at The University of Memphis have developed a GIS lab through Technology Access Fee (TAF) grant funding. Phased implementation of GIS is incorporating progressively more complex and challenging projects throughout the civil engineering curriculum.

Currently, the freshman and sophomore civil engineering curriculum includes a sequence of four required courses that involve students in content rich design as an introduction to the civil engineering profession. While the curricular strategy is appropriate and successful, this project seeks to further enhance students' experiences by integrating a state-of-the art technology across the civil engineering curriculum. The goal of this project is to enhance students' learning experiences not only by actively engaging them in the learning process through a design-based approach, but by also providing the opportunity for students to become proficient in state-of-the art software applications typical in the civil engineering workplace.

The implementation of the current project for the Department of Civil Engineering at The University of Memphis was designed to begin with design projects added or altered in scope to integrate GIS applications beginning with the introductory course in the freshman year of the program, which is the course largest enrollment in the program. Specific courses were targeted along with selected curriculum changes to integrate the GIS-based design experience.

Unexpected Consequences of Thoughtful and Innovative Engineering Education Curricular Reform: Identifying Competing Orientations and Sources of Pressure

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EXTENDED ABSTRACT

Engineering professionals committed to thoughtful and innovative engineering education curricular reform consistent with ABET are acutely aware of the struggles associated with interdisciplinary collaboration. Within the context of accreditation requirements, ideally administrators and faculty work together with input from alumni, advisory boards, employers and students to continuously improve their academic program. But in reality various stakeholders end up being sources of pressure for change, and hence form the basis of a potentially unhealthy competition. This manuscript seeks to identify concerns, provide narrative examples, and detail several *un*expected outcomes (anxieties, execution, assessments, etc.) that can result from the collision of competing philosophical, disciplinary and pragmatic orientations to the scholarship of teaching and learning in engineering. Specific supporting documentation comes from a civil engineering senior design capstone course, a course where faculty, industry, clients and an advisory board are directly involved in varying degree.

Green Building Concepts in the Engineering Curriculum

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EXTENDED ABSTRACT

The capstone design sequence for civil engineering students at Florida Atlantic University is a two-semester course with the goal of encouraging students to use creativity and teamwork to solve complex, real world problems in the local community. Included are elements of fundamental coursework taken prior to the senior year, such as: structural analysis, steel and concrete design, surveying, geotechnical, foundations, environmental, transportation, and drainage. The class typically involves the design of a preliminary site plan and a building, with ancillary issues such as environmental impacts, transportation needs, hurricane resiliency, historical preservation, or multiple uses. All buildings designed during this course are required to emphasize green features (USGBC-LEED®) and minimize environmental impacts. Students make 10 progress presentations, culminating with presentations to a jury consisting of members of the department advisory committee, invited professionals, and interested stakeholders.

The class is team-taught by an academic (representing the fundamental engineering perspective), a consulting engineer (representing the practical engineering perspective), and a former utility director (representing the owner's perspective), with contributions from a variety of outside lecturers to provide both academic and real world connections. The intent is to allow students to transition from purely academic work to solving actual problems in a "real-world" setting. Students thus become active participants in developing a healthy environment for our future by learning how to practice responsible environmental stewardship in design of long-lasting structures. This way they will be better prepared to deal with an ever-changing world and an evolving job market.

This course also offers a demonstration of cross-cutting interaction at a level not easily achievable. For instance, the Transformations project, which began in the Dorothy F. Schmidt College of Arts and Letters, evolved further at the College of Architecture, Urban, and Public Affairs and then was brought forward as the focus for the civil engineering capstone class. Students from the Comparative Studies Ph.D. program, architecture and urban planning, and engineering all participated. The results of the engineering students' explorations were used to raise funds for the actual implementation of this real campus project. Perhaps the most inspiring outcome was when students presented their preliminary ideas to the professional engineers in charge of this project. The industry responded by asking many of them to bring their progressive thinking and essential skills to workplace by hiring them as interns. In this manner, some of the students' designs were incorporated into the final product of the real-world version of the project.

Environmental Scanning for Strategic Planning at Higher Educational Institutions: A Literature Review for Engineering and Technology Faculty

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EXTENDED ABSTRACT

Since the 1980s, strategic planning at higher educational institutions in the United States has become more common in response to the "foundational stress fractures in public support for higher education [Dooris, 6, p.7]. Money is tight nationwide. A well conceived strategic plan will provide all constituents of a university with a vision of the magnitude of assets needed, such as manpower and finances, to support mission attainment. Engineering education administrators must create environments on their campuses which promote efficient spending and utilization of available funds to support their institutional missions. These typically include construction of new buildings, programs to directly support teaching and learning, and accreditation. The strategic planning process for engineering program administrators may be initiated with environmental scans of issues which may affect the core values of the institution. An environmental scan is an assessment of internal and external issues and factors which potentially may impact an educational institution. This paper addresses five common themes for environmental scans for higher education in the United States.

Fort Valley State University Cooperative Developmental Energy Program: A Highly Successful Pre-collegiate and Collegiate STEM Workforce Program for Minorities and Women

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EXTENDED ABSTRACT

As a result of a grant from the U.S. Department of Energy, Fort Valley State University (FVSU) started a technical workforce development program for minorities and women in 1983. The program was named the Cooperative Developmental Energy Program (CDEP).

CDEP is a multifaceted pre-collegiate and collegiate technical workforce preparatory program that consists of alliances with corporations, federal and state agencies, six universities, and middle school and high school counselors. The corporations and the government agencies provide funding for college scholarships, a pre-college outreach program and hands-on work experience via internships.

In 1983, CDEP began as an internship program for academically-talented minority and female students enrolled at FVSU. In 1992, FVSU modified its biology, chemistry, and mathematics curricula offerings so that CDEP could recruit students into 3+2 dual degree programs that would provide students with second degrees in health physics, civil engineering, computer engineering, electrical engineering, environmental engineering, mechanical engineering, nuclear engineering, petroleum engineering, geologic engineering, geology, or geophysics. Via cooperative agreements and memorandums of understanding, the second degrees in engineering, health physics, and the geosciences are awarded by the following partnering universities: Georgia Tech, Penn State University, University of Nevada-Las Vegas, University of Texas at Austin, and the University of Texas-Pan American.

In 1993, CDEP implemented a pre-collegiate outreach program called the Mathematics, Science and Engineering Academy (MSEA). The objective of CDEP's MSEA, is to provide a continuous pipeline from 9^{th} grade through 12^{th} grade to feed into CDEP's dual degree science, technology, engineering, and math (STEM) disciplines. Sixty-one of the MSEA students have enrolled in one of CDEP's dual degree STEM programs.

Since 1997, CDEP and its partnering universities have graduated 58 engineers, 20 geoscientists, and 4 health physicists. Twelve of the graduates have earned MS degrees and three have earned PhD's. Approximately sixty students are currently enrolled in the dual degree collegiate part of the pipeline and one hundred and five are enrolled in the MSEA pre-collegiate part of the pipeline.

Dual Career Faculty Challenges

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EXTENDED ABSTRACT

Faculty members often meet their partners during their graduate studies. This leads to couples that both are looking for faculty careers. In particular, studies show that a high percentage of women engineering faculty members have partners who also have doctoral degrees. The faculty process is challenging enough for one partner, but having two partners looking for jobs, establishing their careers and advancing their careers provides a unique set of challenges and opportunities.

This presentation will discuss 24 years of experience of a dual career faculty engineering couple from graduate school to advancement as a faculty member and administration. Tips for getting initial jobs will come from personal experiences as applicants, search committee members and hiring administrators. Additionally the presentation will include tips for jump starting your careers while dealing with balancing the issues of the two-body problem. Suggestions on balancing professional and personal activities will be highlighted including issues related to children.

The last part of the presentation will discuss advancement as a dual career couple. How do you continue to have challenges for each of you as individuals while optimizing activities as a couple? A list of do's and don'ts related to advancement will be presented. Finally some trends and programs related to dual career couples will be outlined and discussed.

Message Design Considerations for Use of Mobile Learning Content in Engineering Education

Michael Dermody and Christine Russell

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EXTENDED ABSTRACT

Video iPods put true mobile technology in the hands of the masses. While this paper explicitly deals with iPods, the content can be adapted for use with any mobile device. These devices can revolutionize engineering education by providing exciting content delivery innovation. Currently, iTouch iPods support a 16 GB handheld audio/video device that will provide up to 10-20 hours of full motion, combined video and audio content. However, use of this technology is new in education, and improper planning and design may lead to poor learning outcomes. Designing audio and/or video learning content for a mobile 3.5 inch diagonal widescreen color display device presents design considerations for the creator of educational content on three fronts – content creation/organization, video production, and environmental usage. This paper provides a first step look at those considerations based on our experiences working with one large automotive manufacturing plant's early adoption of the media.

Mobile video learning environments, like the iTouch iPods, are their own unique medium and must be designed from the start with that in mind. This paper is designed to identify some of the changes in production and planning of educational material that we believe should be considered in order to create effective training materials in this new medium. These suggestions are made based on the authors' experiences in the early stages of design and implementation of video/audio mobile material created for a management training program for a large automotive manufacturing plant. The project is in the early stages of roll out and as a consequence the suggestions in this paper are made based on short interviews and informal communication with the clients as the medium content is being distributed in this environment. While we do not yet have significant data tied to the learning outcomes assessment, we have learned from the process of preproduction planning and early implementation about some of the likely best practices in designing and executing material in this new medium.

M.S. in Engineering Management with Packaging Concentration

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Christian Brothers University

EXTENDED ABSTRACT

Christian Brothers University (CBU) has offered a successful Master in Engineering Management (MEM) graduate program since 1989. In 2005, the university started online course development for distance education to reach out to more students. This culminated in 2007 with the introduction of a fully online degree, M.S. in Engineering Management (MSEM) with electives focused on information technology. A spring 2007 study on the Memphis-area packaging industry revealed a need for graduates with business skills and packaging background. As a result, CBU introduced two new programs in fall 2007, B.S. in Engineering Management and MSEM, both with a packaging concentration. This paper describes the details of the MSEM with Packaging Concentration program.

The M.S. program is collaboration between CBU and Michigan State University (MSU). Students take eight engineering management courses (24 credits) from CBU and three packaging courses (9-11 credits) from MSU. Upon graduation students get an M.S. degree from CBU and a packaging certificate from MSU. The collaboration takes advantages of the strengths of the two established programs.

The collaboration is made possible with distance education technology. CBU offers two parallel Master's programs in engineering management: the traditional face-to-face Master in Engineering Management and the distance-education Master of Science in Engineering Management. When a course is delivered to live students in the MEM program, it is recorded for use in the MSEM program. This means the distance-education courses are updated on a regular basis. Two classrooms are equipped with video and audio equipment allowing the recording of ten courses per semester or about four hundred hours of lectures. During a recording session the instructor uses a laptop tablet computer to deliver his/her lectures. A screen recording software package is used to capture presentation slides, while a microphone records voice and a video camera captures body movement. The tablet computer allows the instructor to write on its monitor, which is projected onto a screen via a data projector for live students. A recording technician is present in the session to operate hardware/software, so the instructor only needs to concentrate on the delivery of class materials. After the recording session, a technician packages all media components.

Utilization of an Engineering Management Body of Knowledge WIKI for Graduate Distance Education

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EXTENDED ABSTRACT

In 1994 the American Society of Engineering Management (ASEM) launched a collaborative website (WIKI) to support the development of a web-based practitioner's handbook. The handbook is a rough collection of the engineering management body of knowledge (EMBOK) on-line resources and definitions. The structure was designed to provide collaborative website links on the EMBOK. Maintaining an updated refereed WIKI posed a great challenge to a volunteer project team to the point of suggesting its demise. Use of the WIKI for serious application in the field and in the classroom posed additional challenges especially in validation of the source data.

Validity

Much like the popular Wikipedia the EMBOK WIKI suffered from internal and external validity. Rarely is a scholarly peer review conducted on topics. In some cases linked data was from a sole source. However, the value of the WIKI came from the teaching opportunity on appropriate research methods, validating references and providing quick preliminary topically data. Further the student became directly engaged in improving the system through contributing their own research.

Usefulness

In 2005 it became necessary to mirror the site at the University of Tennessee Space Institute (UTSI). The ASEM Board Members voted to take the port of entry to the WIKI down due to criticism of broken links and poor external validity of materials. The mirrored site became parochial to the UTSI engineering management graduate program as links were updated and added on UTSI EM graduate study interests only. It takes an EM village to maintain a EMBOK WIKI.

The author tracked the number of hits on the WIKI over a two year period. This period coincided with the previously mentioned mirrored site duplication and assumed that most hits could be attributed to UTSI EM MS and PHD students. The typical student is a full time employed engineer or scientist with a minimum of three years of managerial experience. A major are participating synchronously at distance education facilities throughout the State. The top most visited topics on the linked sites were in order: 1) Information Systems, 2) Accountability, 3) Conflict Resolution, 4) Quality Improvement, 5) Database Management, 6) Analytical Methods and 7) Engineering Economy.

Teaching Tips

The WIKI was most useful when:

- the instructor had online access in the classroom and at the distance education facilities. This allowed for a lively discuss and real time scholarly pursuit with students.
- the student had previously taken a research methods course or familiar with validation techniques of references.
- a set of research questions and lesson plan was presented at the start of the class. Interaction with the WIKI like sole adventures on the INTERNET can lead far and wide of the original intent. In summary "Chase down the paths but summarize the final learning points"

An Approach to Determine the Industrial Engineering Body of Knowledge through Concept Mapping

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EXTENDED ABSTRACT

PURPOSE

The goal of this paper is to propose a systematic approach to developing an industrial engineering BOK that incorporates core and supporting concepts and links these concepts into an integrated understanding of the discipline. An IE body of knowledge can assist organizations define and improve the industrial engineering competencies of their workforces; and it can help educational institutions define industrial engineering curricula. The latter is the primary objective of this study.

METHODS

We use the ABET program criteria for industrial engineers as a starting point to identify the knowledge and skills needed by practicing industrial engineers. In order to get an in-depth understanding of these activities, concepts maps are applied. The steps used to develop the concept map are the following:

1. Focus on a theme and then identify related key words or phrases as labels.
2. Rank the labels from the most abstract and inclusive to the most concrete and specific
3. Cluster labels that function at similar levels of abstraction and those that interrelate closely
4. Arrange labels into a diagrammatic representation
5. Add attributes to each label if/as appropriate
6. Connect the labels with linking lines and name each link-line with a relationship description.

CONCULSIONS

The project team has attempted to match the scope of its efforts to the scope of the project. Preliminary results from the project are available to date, but it is hoped that the steps that have been taken to date and the results that have been achieved will be helpful to others who might undertake future curriculum renewal projects.

Ultimately, a defined Body of Knowledge will provide Industrial Engineering students, faculty, and practitioners with a stronger connection between what IIE and ABET define as industrial engineering and what the practitioner does an industrial engineer. Perhaps, it will enable IE's to respond to "IE stands for Imaginary Engineer" with, "No, although we use our imaginations to solve problems on a system's scale, we are Integrating Engineers – without us, systems fall apart!"

Navigating the Reality of Textbook Edition Management

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EXTENDED ABSTRACT

Ever wonder about the endless flow of textbook editions? Ever consider what you as the instructor can control? Ever wonder about a value or cost statement that a new release has on your course? In this paper we present differing perspectives on the need and value of new editions to textbooks, what drives the release of new editions, the impact on students and faculty, and current trends with new releases. We conclude with suggestions instructors can use for their own version of textbook edition management. These suggestions include:

Adopt new editions when released – instructor simply absorb the time cost to adopt new editions when released. This is the option your publisher and bookstore prefers.

Continue using an old edition – instructor does not convert to the new edition when released.

Specify a book that is out of print – specifying a book that is no longer in print will guarantee no new editions.

Work with your local bookstore – generally your campus bookstore will try to work with the faculty.

Create your own problem sets – generally, problem sets are the most significant change between editions.

Compile your own textbook – create your own textbook with on-line tools provided by publishers.

Create your own textbook – a final option is to create your own text.

An Automated Class Scheduler

Ray Seyfarth and Cheryl Pierre

University of Southern Mississippi/Department of Defense

EXTENDED ABSTRACT

Professors at Southern Miss serve as advisors to students and help with class selection each spring and fall. The classical method of course selection involves studying a class schedule guide to determine when the desired courses are offered. Unfortunately this process is fraught with troubles:

1. Different courses are frequently taught at conflicting times. This might mean that the desired classes cannot be taken or it might simply make it more difficult to discover a non-conflicting schedule.
2. Classes frequently close and the schedule guide does not indicate which courses are closed. The student and advisor must consult a printout to discover which classes are closed from the desired set.
3. Classes frequently have their scheduled time changed after the schedule guide is published.
4. New classes are offered which do not appear in the guide.
5. There are usually many possible non-conflicting schedules. In this case it is desirable to select courses based on student time constraints.

All these problems contribute to a frustrating experience for students and advisors. Clearly the data for all open classes is stored on computers and no one should flip though a printed copy of the offerings to discover the best schedule for a student.

In this talk we present two solutions. The first was an ad hoc solution which eliminated searching by hand. The second solution is a web-based solution which produces optimal schedules based on student time preferences. This has the potential to save thousands of frustrating hours, while producing optimal results.

Poster Session Abstracts

The Southeastern Section of the American Society of Engineering Education (ASEE) has solicited extended abstracts from undergraduate students to present in a poster session at this year's conference. The students will be entered in one of the following categories:

- Freshman/Sophomore Engineering and/or Engineering Technology Design Teams
- Junior/Senior Engineering and/or Engineering Technology Design Teams
- Undergraduate Research

The following section contains the extended abstracts from this year's student participants. During a morning judging section, they will be evaluated on their abstract, poster, and communication skills. In the afternoon, the Research Division encourages all conference attendees to stop by and learn from students about the wonderful projects going on throughout the section.

Blackdog UGV System

Darryl Clark and Janelle Hilliard

Embry-Riddle Aeronautical University / Computer and Software Engineering Department

EXTENDED ABSTRACT

Purpose

The purpose of this project is to create a fully autonomous Unmanned Ground Vehicle (UGV) system. This system will be able to operate in conjunction with a previously developed Unmanned Aerial System (UAS) system in order to get a closer look at targets identified by the UAS. The goal is to create a system that reduces the number of lives lost in dangerous endeavors such as military operations, research, law enforcement and natural disasters.

Methods

Our system utilizes the Python programming language and its extensions in the software ground stations. The storage center for the UAS and UGV's data are networked virtual objects that use a PYRO (PYthon Remote Object) connection to communicate with the rest of the software. The UAS can read information about the UGV from its virtual object and either adds waypoints to its queue, or request the UGV follow the UAS's movement. The Graphical User Interface polls the virtual object to update the user's display. The UGV's intelligent navigation is assisted using a D* algorithm to plot a path around obstacles. The UGV's hardware ground station utilizes a Dragon 12 evaluation board running a Motorola 68HCS12 micro-controller with GPS, a manual-override controller, and power management integrated on-board.

Team selection was completed based on majors and interest. There are eight software engineering, two computer science and two computer engineering majors for a total of twelve members. There are four – three person teams: GUI, Object / Communications, Control and Hardware.

The engineering process used was based on Crystal Clear process. Crystal Clear is an agile process that utilizes frequent delivery of usable code, osmotic communication, reflection workshops and iterative development. For our team, two week iterations and product deliveries were deemed appropriate for a two semester project and have worked extremely well.

Results

The system development spans one academic year, which is nearing its conclusion. Currently the UAS and UGV are working products however the two are still in the process of being integrated. The UAS has been tested and deemed complete while software and hardware are being finalized for the UGV. The team is currently on schedule for a completion date of April 30, 2008.

Blood Separation in Microfluidic Devices

Eric Chung and John Wikswo

Vanderbilt University BME Department / Vanderbilt University Department of Physics

EXTENDED ABSTRACT

Microfluidics is a relatively new area of science used in measuring biomedical signals. Blood cells were trapped and then separated. The difficulty in this experiment is that trapping cells because it requires extreme amount of precision. However, to add on to that difficulty, the experiment focuses on separating white and red blood cells within the device. Because of the shape of red blood cells, the device is capable, with the correct trap size, to trap white blood cells and allow red blood cell will flow through. The second part of the experiment is focused on creating single cell measurements and determining cell characteristics. By obtaining fluorescently marked CD markers, the strength of the fluorescence shows the amount of clusters that respond to the marker. CD markers were shown to display greater fluorescence when bound and were easily distinguishable from the media that the cells are suspended in. For the purpose of using multiple CD markers the syringe pump was placed at the output of the device instead of the input and pulled back on. At the input of the device a computer controlled valve bank created through unique photolithography technique.

Results

The results showed that white and red blood cells can be separated by size. Platelet congregation interfered slightly with the separation. However, most of the cells remaining within the device were white blood cells. Microbeads were used to test the new method of pumping and worked similar to the forward pumping method. The valve bank fabrication is still undergoing work and needs test in repeatability. The cells were marked with three different CD markers and showed fluorescent under different filters. This showed that white blood cells could indeed be differentiated by using multiple markers and filters under microfluidic devices.

Synthesis and Characterization of Dextran Coated Mn/Zn-Ferrite Nanoparticles for Cancer Treatment Applications

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Department of Chemical Engineering, University of Puerto Rico, Mayagüez

EXTENDED ABSTRACT

Previous studies have shown that magnetic nanoparticles possess great potential as cancer treatment agents when stabilized under the proper conditions. The goal of this study was to obtain a magnetic fluid produced by the colloidal suspension of manganese/zinc ferrite (MZF) nanoparticles with sustained stability throughout the range of physiological pH and ionic strength. The MZF nanoparticles were stabilized by coating with carboxymethyldextran (CMD) to provide steric repulsion between the particles, thus avoiding agglomeration. The MZF nanoparticles were synthesized by chemical co-precipitation with an expected degree of Mn substitution in the ferrite structure equal to 0.5. To determine the actual degree of substitution, samples of the resultant magnetic fluid were analyzed using Inductively Coupled Plasma (ICP) spectrometry. Zeta Potential measurements were made to determine the behavior of the CMD-MZF complex when subjected to pH changes in the surround medium. This study showed satisfactory stability at pH in the range of 6 to 11. However, the CMD-coated nanoparticles showed reduced stability when the acidity of the magnetic fluid was increased to a pH lower than ~4.0. Dynamic Light Scattering (DLS) was used to measure the particle size distribution. The mean hydrodynamic diameter of the CMD-coated nanoparticles was 38.4 nm, demonstrating low particle agglomeration at neutral pH. This allowed for a proper suspension of the CMD-coated MZF nanoparticles and, thus, the formation of a relatively stable magnetic fluid. Cytotoxicity experiments in various human cancer cell lines are currently underway.

Characterization of Al-Cu Alloys Reinforced with Dodecaborides

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EXTENDED ABSTRACT

Aluminum matrix composites have potential in structural and aeronautical applications because of their high resistance to corrosion, excellent mechanical properties and low density. Therefore a careful characterization of their phase transformations upon processing and resulting mechanical properties is essential. In the present work we have fabricated aluminum alloys reinforced with AlB_{12} particles via gravity casting. The specimens were heat-treated and analyzed using optical microscopy, Vickers microhardness, advanced x-ray and differential thermal analysis. Our results demonstrate the lack of stability of AlB_{12} in contact with liquid aluminum and the subsequent of the dodecaboride into smaller AlB_2 particles. These findings have prompted us to investigate alternative AlB_{12}-stabilizing elements added to the Al melt.

Modeling Gas Diffusion Through Expanded Polystyrene Using Cellular Automata

Nicholas G. Currier

Tennessee Technological University

EXTENDED ABSTRACT

Modeling of the diffusion of gases through EPS can aide the lost foam casting industry in understanding the methods that can alter pyrolosis products during a metal pour. These products are thought to have a significant impact on the quality of a metal pour. Cellular automata (CA) present a reasonably effective and accurate method of modeling these diffusion processes and have been proven to provide good correlation with experimental data. The previously accepted method of implementing these CA models was to allow every particle in a mass occupied cell location to randomly walk until every particle was acted upon. The method presented within involves the partitioning of numbers to avoid the need to randomly walk each particle when a CA model cell site was occupied with multiple particles. This produces a reduced operations count and inherent increase in execution speed of the model.

The research led to the disproof of the validity of earlier models and the introduction of new methods for modeling gas diffusion in EPS. Several numerical experiments were performed and the stability of the opposing methods was analyzed. The partitioning method of cellular automata was shown to be numerically stable while the equi-distribution method showed questionable sensitivity to initial conditions. The equi-distribution method proved to not be representative of the stochastic process of gas diffusion and is therefore unfit to model these processes without extensive modification. A blending of the two methods was proposed for future study to gain both the speed of equi-distribution and the stability of partitioning schemes.

Establishing Procedural Steps for Reverse Engineering Solutions with 3D Scanning and Rapid Prototyping

Marcus Czapla
Albany State University; Albany, Georgia

Extended Abstract

Development of laser scanning technology to input object geometry directly into a printable model in a Rapid Prototyping Machine has significantly shortened the product development cycle and its associated cost. With a laser scanner an object is scanned multiple times over its entire surface and the resulting data is assembled into a digital 3D model utilizing specialized software.

Reverse Engineering is the process of taking a finished product and reconstructing design data in a format from which 3 dimensional computer models can be produced. The most common applications of reverse engineering are replacement of obsolete or worn out parts, non-availability or unwillingness of supply from original parts manufacturer, extension of original design for new application, cataloging of one of a kind objects and medical devices (dentures, prosthetics) etc.

In order to produce a truly editable parametric model the resulting 3D file must imported into conventional CAD software that is capable of analyzing the models geometry and extracting parametric features. The resulting model can then be edited as desired by the downstream operator and printed in a rapid prototyping machine to check for functionality

The work reported here is to clearly define the steps necessary to prepare and scan an object, assemble the 3D digital model and then repair holes and other abnormalities in order to produce a watertight model that can be printed in the 3D printer. For the current work, a less expensive 3D Scanner, E-Scan with merging / aligning software was used along with stand-alone software LeiosMesh for post-processing the digital model. The capabilities and versatility of this software is also being explored in order to produce higher quality and more complex models.

Dynamically Maximizing the Performance of Large Data Transfer over Dedicated Network Links

Benjamin Eckart

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EXTENDED ABSTRACT

New networks are emerging for the purpose of transmitting large amounts of scientific data among research institutions quickly and reliably. These characteristics of these networks only marginally resemble those of the Internet and as a result render the established Internet protocols ineffective. Recent methods have been developed to circumvent these problems, including new protocols which implement both reliable (TCP) and unreliable (UDP) data transfer algorithms. The construction of faster networks and more efficient protocols, however, doesn't necessarily result in better data transfer performance. At speeds of 10 Gigabits per second or more, the end-systems involved may be unable to support such speeds due to hardware limitations of the CPU and hard drive. It is therefore necessary to build a high-speed protocol adaptive the performance of each system. This research develops such a protocol, Performance Adaptive UDP (PA-UDP), which aims to dynamically maximize data transfer performance under many system environments.

A mathematical model is proposed to describe the theoretical basis behind effective buffer and CPU management. Based on the formulas derived from this model, a dynamic flow control algorithm is developed that uses a feedback system to monitor the hosts during the data reception period. By monitoring the performance of the systems, the transfer rate between hosts can be adjusted dynamically to match the optimal sending rate predicted by our equations, achieving stability and high performance. A prototype based on the PA-UDP architecture is implemented as an application level protocol and the experimental results demonstrate that it outperforms other high-speed protocols on commodity hardware. Experiments also show that the prototype closely matches the theoretically optimum throughputs predicted by our formulas. We can conclude that PA-UDP is an effective protocol for reliable high-speed bulk data transfer.

Impact of Outsourcing on the Performance of the Furniture Industry Supply Chain

Daniela Gonzales and Sandra Eksioglu
Department of Industrial and Systems Engineering, Mississippi State University

Extended Abstract

Many US furniture companies see outsourcing as an option to remain competitive. In fact, in this industry it is estimated that the price difference between buying a product from overseas (primarily from China) versus producing it in the US is about 20% to 30%. However, the price difference does not capture other costs and risks associated with outsourcing furniture components from low-wage countries. We develop a simulation model of the furniture supply chain that captures the uncertainties with respect to lead times and to the quality of products being outsourced. The model simulates the flow of materials from domestic and/or overseas suppliers to furniture manufacturers and the flow of finished products from manufacturers to retailers. The simulation model is used to perform a number of "what-if" analyses. The results of the analysis indicate that outsourcing has a large impact on the inventory level, safety stock, and as a consequence on inventory holding costs.

Design of Toyota Sleeve Changing Device

Debi Eley, Jasmine Huang, Justin Montgomery, Blake Waggoner, Ethan Wilding

Union University

EXTENDED ABSTRACT

Bodine Aluminum, Inc., a Toyota company, changes 750-lb shot sleeves in high pressure die casting machines 120-130 times annually as part of the manufacturing of its Camry V6 and V8 engines. The current device used for changing shot sleeves needs engineering modification or redesign for performance improvement. Weaknesses that need improvement include intensive manual labor, safety and ergonomic issues, and large time consumption. Bodine Aluminum communicated a need for improvement to the Union University Engineering Department. Project objectives are to design a device and/or process that will safely and ergonomically remove a shot sleeve and install a new shot sleeve while reducing the cycle-time by 50%. Upon completion, project's financial savings of $264,000 annually due to reduced downtime. The payback period is expected to be 2 months. The most significant result, however, will be eliminating all ergonomically unsound processes from the shot sleeve change procedure.

This poster presentation will focus on the design of the internal support arm and the experience of selecting, designing, engineering and building an industry-sponsored capstone project.

Internal Support Cantilever Beam

One key change of the new design is to utilize an internal support arm inside the sleeve rather than allowing the shot sleeve to rest on an external support platform for insertion and removal. This support arm will be a cantilevered beam that fits inside the shot sleeve. The selection of the material and size of the cantilever beam will be done based on mathematical and computational simulation and analysis.

Project Structure

The design team worked closely with both Bodine Aluminum and its contracted machine shop in selecting, designing, engineering, and building this project. The experience was educational in real-life applicability, project management, engineering methodology (Design cycle, why-why diagram, Gantt Chart, etc). This design project utilized consensus management techniques for decision making, with a single liaison for communicating with the representative groups. The group consisted of a small team of five senior engineering students in the Major Design class.

Female Mentoring Efforts in Chemical Engineering at Tennessee Tech: Collaboration among Students, Faculty, and SWE

H. Hunter and C. Holt
SWE Chapter, Tennessee Tech University

EXTENDED ABSTRACT

The Department of Chemical Engineering at TTU has seen an increase in the number of female students that apply and then register to the program. However, not all these talented students remain in the program. Some of them transfer to other disciples, many by reasons that seem to be misinformation and/or lack of encouragement. In order to increase the retention of our female students and in collaboration with SWE, a formalized female mentoring program has been initiated to insure that more students successfully finish a Chemical Engineering degree. The efforts of upperclassmen, graduate students, and faculty combine to guide freshmen and sophomores through their beginning semesters. The program promotes synergistic effects for everyone in the Department by offering social events, professional development and tutoring as needed. These activities develop not only professional relations but friendships. Historically women enter math and science fields at a lower rate than their male counterparts, and issues affecting retention have been identified to include social isolation, confidence in performance, and concerns about life/work balance. The program structure is designed to address these issues. The support and confidence gained from the mentor groups help women succeed in early academic challenges such as math coursework or inter-gender teams, while helping students build a network of professional relations and friendships. Preliminary feedback from the students seem to indicate that the confidence and knowledge gained from the mentor groups help women succeed in what is becoming a more diverse degree.

Design Improvements to Simple Wire Rope Bridges

Aaron Jacques
Lipscomb University

EXTENDED ABSTRACT

The aim of the 2007 bridge construction trip to Chicacao Guatemala was to design and construct a structure for crossing the local river that improved upon the bridge design installed downstream in the summer of 2006. The local village was in desperate need of a way to traverse the river safely and easily. The previous iteration of the suspended wire rope bridge had noticeable vibrations upon loading, a minimum amount of clearance to flood conditions, and little resistance to transverse loadings.

The project was guided by the project leader David Fann who organized the logistics of procuring materials, lodging, and relations with the local village that the bridge was to benefit. Within the guidance of the project leader, volunteers, both professors and students, were broken down into two teams; bridge design and bridge construction. An upperclassmen and professor who were intimately involved with the bridge trip of the previous year were assigned to be team leaders, giving guidance and doing the bulk of the design and planning.

The previous Guatemala bridge of 2006 was the first iteration and an excellent starting point for design. Both bridges are constructed of two concrete bases approximately 100 feet apart on either side of the river; a wire rope connects the two bases and supports the bridge decking. The bases are in the shape of a large stairway with two pedestals placed on the top landing to support the handrails. Bridge decking is a simple expanded metal grating welded onto box beams which were then securely bolted to the wire rope. The shape of both 2006 and 2007 designs were modeled by a parabola. Although a catenary is the more general contour for a suspension bridge, the parabolic contour was appropriate for the bridge span and the sag chosen for the design. The basic design and mathematical model from the 2006 design carried over as the concept behind the 2007 bridge. In 2007, to improve the freeboard between the river and the bridge, the geometry of the base increased in both height and width from the previous iteration. The width increased to prevent the tipping and sliding of the base in the direction of the river. Vibrations due to dynamic loading in the previous design caused minor difficulty in traversing the bridge, and only increased with the addition of people, a problem addressed in the 2007 design. The handrails were tensioned, placed outboard of the main load bearing cables, and connected to the walkway cable with a sliding joint. The aim was three fold; increased lateral support of the entirety of the span, bear a small percentage of the load, and provide a resistance to the vibration of the walkway.

The 2007 bridge design successfully achieved its goal of improving on the previous bridge design. The freeboard over the river improved significantly but was less than expected due to a translation error in the drawings used to construct the bases. Placing tension in the handrails justifiably improved the dynamic stability under the loading of any number of pedestrians. It was assumed that the ability of the bridge to handle transverse loads increased, although no observations of strong wind on the bridge were noted during the duration of our stay. The 2007 Guatemala bridge trip went smoothly with little problems during construction, providing a stronger, safer, and more robust bridge design.

Design Guideline for the Use of Recycled Expanded Polystyrene Gravel in Drainage Applications

Navid Jafari
Department of Civil Engineering, University of Memphis

EXTENDED ABSTRACT

Expanded polystyrene (EPS) is a polymeric foam that can be found in some familiar consumer products such as coffee cups and cushioning packaging. Therefore, due to the large quantity of post-consumer EPS waste generated world-wide from packaging and other EPS uses, a need currently exists to find uses for recycled EPS. The use of recycled EPS gravel in drainage applications is one possible source to deplete the availability of post-consumer EPS. However, a recommended design guideline for the use of recycled EPS gravel in drainage applications is currently unavailable. The availability of a comprehensive design manual will encourage designers to consider recycled EPS gravel in drainage applications in the future because the use of recycled EPS gravel may yield more technically and cost efficient designs. The availability of a design procedure requires the accumulation of preliminary data on the engineering properties of EPS gravel bundles. The engineering properties that are currently being evaluated include stress versus displacement and stress versus water flow.

Design of Experiments in the Motorsports Industry

John Greg Jones, Dr. Cindy Waters
NCA&T Mechanical Engineering

EXTENDED ABSTRACT

Currently, there is a need for more effective ways to integrate statistical methodologies such as Design of Experiments (DOE) into the engineering curriculum. Aptitude with statistical methodologies such as DOE was identified from conversations with our Industrial Review Board as an essential skill for engineers and one that we had not been adequately addressing. Faculty discussions identified that this requires not only knowledge of statistical concepts related to DOE, but also the ability to integrate this methodology with fundamental engineering principles toward designing and understanding experiments. As a result our DOE lab course was created. The final project is meant to combine classroom knowledge with the individual creative design of full factorial studies of the students choosing. The final projects of the students are quite imaginative. One in particular that will be discussed deals with the motorsports industry. The student consults in the motorsports industry and in the classroom recognized immediately that the concepts of DOE and factorial design could be powerful tools. To be able to determine a problem and solve the problem the problem quickly and accurately produces a definite competitive advantage in the motorsports industry.

In the motorsports industry testing is at a premium. It represents an increased need for funding and stress on the staff. So to generate functions or procedures to reduce this is of great value. Tire testing is one of the most difficult forms of automotive testing which is accelerated in motorsports. To reduce the uncertainties in tire testing and to accomplish the above concepts would yield a definite advantage. What follows is a report of test that accomplished all of this by utilizing a Design of Experiments.

The problem or the experiment/test was already present we simply created the solution to the problem by using a software application (Minitab) and procedures outlined in a Design of Experiments. The DOE provided the test staff with away to rigorously and systematically approach the solution. It provided the run order sequence for the test plan and facilitated the systematic recording of data.

These concepts were applied for a Grand-Am Rolex series tire test. The test was held to evaluate the implementation of a new Pirelli® tire. Specifically this report was generated form the test that was completed in evaluating the rear tire wear for a Porsche 997 GT3 vehicle. The test process was greatly reduced by the use of Minitab and the DOE.

Maintaining Long-Term Cell Viability in a Perfused Bioreactor System

Jenny Lu
Vanderbilt University

EXTENDED ABSTRACT

Fabrication of a small scale bioreactor system with improved delivery of drugs or assay reagents can be highly beneficial to the development of an anti-tumor therapy, and key cellular functional signatures will be identified to predict the response to anti-tumor therapy. Experiments show that 5000 cells/chamber of human mammary epithelial cell lines (MCF10A) in chamber slide is optimal for the 3D formation of acini morphology or mammosphere during 20 days, and that correlates to 2000 cells/well in the parallel channel bioreactor. After comparing the gene expression profiles from Microarray Data Set, only a few protease family classes are differentially expressed by four cell lines. Effects of individual inhibitors and protease cocktails are compared. 1μM of Calcein AM and 2μM of Ethidium Bromide are the optimal concentrations for the live-dead viability assay. The new and improved parallel channel bioreactor design is a high thru-put device that allows optical capabilities.

Design and Implementation of an Ethernet Laser Projector Controller

James Johnston, Jerry Mayers and Ivan Delgado

Southern Adventist University

EXTENDED ABSTRACT

Laser projectors are beneficial over traditional projection systems because of their high contrast, visibility in bright light environments, and their precision. Current laser projector controllers frequently use a USB or PCI interface that limits the scalability of the system and places a proximity requirement on the host computer. This project solves that problem by replacing the traditional interface with a custom Ethernet-based laser projector controller board. This allows a single PC to control a virtually unlimited number of laser projectors over any TCP/IP network.

A standard laser projector utilizes scanners (galvanometers with mirrors) to direct a laser based on analog inputs. A laser projector unit contains a laser, two scanners for the X and Y axes, and analog circuits with a standard low-current analog signal interface to drive these components. An image is essentially vector-based and consists of a list of points. A laser projector controller continuously iterates through this list and sends each point over the analog interface.

Design and Implementation

Requirements were to iterate through the points in the image at a frequency of 30 kHz while achieving the same level of still image quality and functionality of a commercial PCI card. Three subsystems were designed and developed to control the laser projector. A dedicated Atmel AVR8 microcontroller interfaces with the scanners and laser through digital-to-analog converters (DACs). A second Microchip PIC18 microcontroller handles Ethernet communication and hosts a custom TCP server. A custom C# GUI drawing program on the PC allows user entry of images and downloads them to the Ethernet microcontroller, which in turn forwards commands and data to the first microcontroller via a serial interface.

Testing and Results

Numerous images of various sizes have been successfully downloaded and projected. Results visually indistinguishable from the commercial PCI card were achieved on the second prototype after changing the DACs and op-amps. Due to external memory issues encountered on the Atmel microcontroller, iteration of points had to be moved to the Ethernet microcontroller. This limited the point frequency to 25 kHz. A future board revision would solve this problem.

Team Structure

A decentralized organizational structure was chosen, and the team divided the project into separate areas. James Johnston was responsible for the hardware design. Ivan Delgado was responsible for firmware. Jerry Mayers was responsible for application development on the PC. Integration was achieved through working meetings between the leaders in each area.

Enabling Interaction for Kids in Bumbo Chairs

Robert Mazza, Matt Carroll, Joseph Branam, Vipin Joseph, Kasia Pietras
University of Tennessee at Chattanooga

EXTENDED ABSTRACT

The purpose of this project was to design, develop, and produce a custom table that allows for up to four children sitting in Bumbo chairs to sit together and interact with each other. A Bumbo chair is a small, soft chair made of a foam-like material that conforms around a child's sitting posture and gives support to the child. These chairs are commonly used for children under one year of age. This chair is frequently used by Signal Centers; a group of day schools in southeast Tennessee caring for young children with and without physical and mental delays. The children need a surface area on which they can place small objects such as toys, food, and educational materials. The original manufacturer offers a tray as an accessory to the Bumbo chair; however the staff at Signal Centers has identified several problems with this tray. First, the tray can only be used by an individual child; not groups. Second, the tray is also unstable, making it unsuitable to hold drinks that may be spilled. Third, the staff has complained that it is difficult to attach the tray to the Bumbo chair, and that children are often able to remove the tray themselves. It was therefore the goal of the design team to create a table that eliminates all of these problems while allowing the children to interact with each other.

The project was offered as one of many student team projects in the University of Tennessee at Chattanooga's (UTC) freshmen Introduction to Engineering Design (IED) course. Students elected to work on the project because of individual interest in the project topic and customers.

To begin the project, the design team identified, through discussions with the customers, functions and objectives the table should meet. Some of the requirements include being portable (light weight and not cumbersome), conforming to the design of the current Bumbo chair, and being safe for children less than one year of age. The design team brainstormed and developed several different designs which were then presented to the faculty and staff at Signal Centers for evaluation. A design was selected and a functional, wooden prototype was produced and then tested by the customer who made suggestions for improvements. The final design includes a top made from high density polyethylene plastic and commercially available metal table legs. The table legs allow the table's height to adjust, especially to an uneven floor. The legs are also detachable for storage purposes. High density polyethylene was selected due to its low cost, light weight, and durability. The polyethylene was milled by the student team using a CNC router.

The designed table meets all the objectives, functions, and constraints defined by the customers. Weighing 18 lbs, the table meets the requirement of weighing less than 25 lbs. The table was specified to safely hold 50 lbs; however it was tested to safely support over 150 lbs. The legs are removable so that the table can easily be put in storage when not in use. The table is stable and does not tip over easily. This is important because many of the children at the school are learning to walk and will hold on to the table for their own stability. The materials used in the table ensure that it is durable and will remain in service at Signal Centers for many years.

Evaluation of High Density Polyurethane as a Ground Vibration Barrier

Ben Carnell, Elizabeth Penn-Sanders, and William Hay
The Citadel

EXTENDED ABSTRACT

Ground vibrations are commonly generated during construction activities. As the construction generated ground vibrations disperse from the activity areas, they have the potential to cause annoyance to people who live and work around construction projects as well as damage adjacent structures. Therefore, low cost ground vibration mitigation methods are of interest to the construction industry.

High density hydro-insensitive polyurethanes are commonly injected into soils to improve bearing capacity and settlement characteristics of insitu soils. These materials can be placed into soils with minimal effort via the use of pressure injection systems and copper tubes inserted into the ground with commercially available air compression tools. If injected at certain depths, these materials have the potential to form a ground vibration barrier that can mitigate construction generated vibrations.

The use of high density hydro-insensitive polyurethanes as a ground vibration barrier was evaluated at the Citadel Geotechnical Experimentation Site (CGES). As the polyurethane was injected into the soil with depth, ground vibrations were generated via dropping a concrete block weighing approximately two tons. Surface ground vibrations were measured at set intervals in front of and behind the barrier to evaluate its effectiveness. Analysis of the data showed that high density hydro-insensitive polyurethanes injected at certain depths does not provide significant ground vibration mitigation.

Designing treatment protocols via tumor growth simulations

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EXTENDED ABSTRACT

Cellular adaptation to changing environments is intricately coordinated through many molecular and mechanical responses. As cells evolve, abnormal growth patterns occur (that cannot be controlled by normal mechanisms) leading to cancer. With mathematical modeling we can integrate different characteristics of tumor growth for a non-experimental study of cancer. Through integration of some of the prior clinical, experimental, and mathematical studies, we utilize a cellular automata model to take into account multiple factors affecting tumor growth in healthy tissue. This in silico simulation model of tumor growth is based upon molecular and life cycle features that affect the growth rates of cancer. The life cycle parameters used in this model include replication rate, nutrient and oxygen concentrations, and possible drug effects in a 3-D simulation. The in silico model is used to study the effects of drugs upon the growth and development of the tumor and optimize a drug treatment protocol under various conditions.

Discussion

At this stage in the project, we are able to model tumor growth on a 3-D grid and simulate the different effects that a drug can have on tumor growth by changing the ages and probabilities of death and division. This is crucial to ensure that the simulation parameters can regulate the growth of tumor. By varying not only the growth but also the life of each cell, we can compare and contrast different parameters and study the impacts prototype drugs may have in detail. We have seen (qualitatively) that the four major parameters (age of death, death probability, age of division, division probability) can have a significant regulatory effect upon the growth and development of a tumor when modeling different stages of tumor growth by varying the Gompertzian parameter, α.

Integrated Design and Analysis of Diamond-Coated Cutting Tools

Anderson Renaud, Christina Ibrahim and Ryan Nelms

The University of Alabama – Mechanical Engineering Department

EXTENDED ABSTRACT

Diamond-coated cutting tools are attractive alternatives to polycrystalline diamond tools for machining lightweight, high-strength components made of advanced materials such as composites. However, residual stresses induced by the diamond deposition process, due to thermal mismatch between diamond and the substrate, significantly impact the coating-substrate adhesion, and thus, the tool performance in machining. Moreover, the tool geometry, particularly at the very tip, complicates the stress fields because of the geometry changes. The objective of this research is to investigate the effects of critical tool geometry parameters on the residual stress augmentations around the tool tip.

In this project, Pro/Engineer software was used to create the solid model of various tool geometries. Pro/Engineer can create an accurate model of the tool, which emulates each aspect of the tool geometry, e.g., as small as 5-micron edge radius on a 12.7-mm tool. The solid model was then exported to ANSYS software for 3D finite element simulations of residual stresses generated in the tool with given deposition conditions. The obtained stress data was transformed, coordinate-wise, to evaluate the interface stress profiles around the tool edges. Current results show that the cutting edge radius is critical to the stress concentrations around the tool tip. For a 5-micron edge radius, the radial normal stress increases from 0 at the bulk surface to about 1 GPa in tension, and the circumferential normal stress increases from around 2.5 GPa in compression to over 3 GPa.

To systematically investigate tool geometry effects, the test matrix, determined using the design of experiments approach, includes 4 factors (edge radius, relief angle, nose radius, and insert shape) and 2 levels with a full factorial design. Statistical analysis will be performed to quantitatively reveal the significant factors and interactions between the factors that dominate the stress concentrations. In addition, a white-light interferometer (3D optical profiler) is employed to assess the tool geometry, before and after coating. The results will offer tool makers guidelines in the design of diamond-coated cutting tools.

Modification of a Sensor Board for Improvement in Monitoring Metal Fill During Lost Foam Casting

Justin L. Russell

Western Kentucky University, Bowling Green Kentucky

EXTENDED ABSTRACT

The objective of this project is to improve an existing sensor board, used to monitor metal fill during lost foam casting. The primary improvement will allow the output voltage of the board to be dependent only upon the change in mutual capacitance of the board's two capacitive probes, whereas, in the current design, the output voltage is dependent upon both the mutual capacitance of the probes, and the capacitance between the receiver probe and the grounded metal. A secondary objective of the project is to allow the circuit to be simulated in SPICE-based simulation software. Some modifications have been made to the original circuit board during the simulations, and it has been shown that the output voltage is now only dependent upon the mutual capacitance of the probes. Although the majority of the sensor board has been successfully simulated, there are still some minor components, such as the squarewave oscillator and the power supply portion of the circuit, that were not included in the simulations due to time constraints. Future work will need to be done to achieve simulation data for the entire circuit board.

Static and Dynamic Analysis of SAE Baja Car Frames

Bryan Snow and Matt Snow

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EXTENDED ABSTRACT

The Society of Automotive Engineers (SAE) student organization at the University of Kentucky designs and builds a Baja car, an off-road vehicle, every year and enters a nationwide competition. One major task in building a successful Baja car is to design a strong and yet weight efficient frame (roll cage). The finite element analysis (FEA) software, ANSYS, was used to analyze the static and dynamic performance of SAE Baja car frames. The analyses were performed on the previous Baja car frame and the new Baja car frame that was built for this year's competition. The solid models of the frames were built using design software SDRC-IDEAS. The finite element models were created using beam elements. The finite element models were then brought to ANSYS for static and dynamic analyses.

The Baja car competition consists of static and dynamic events. To simulate the performance of the cars at these events, the frames were analyzed at both static and dynamic loading conditions. The static loads were applied to the frames at various locations to determine the maximum deflections. The modal analyses were performed to extract the natural frequencies of the frames. The results were used to improve the design of the new frame. Using ANSYS, it was very easy to make changes to the frame to determine different ways to improve the design. The final results show that the newly design Baja car frame has less deflections under static loading and higher modal frequencies to withhold the dynamic loading.

Design of an Off-Vehicle Tire Testing Device for Endurance, Wear, and Traction

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EXTENDED ABSTRACT

Design Objective

This abstract describes the first phase of a multi-year project to design a means to test tires off-vehicle for long distances under varying terrains and environments, specifically sand and soft soil. The developed test apparatus will test tires with an improved degree of accuracy and under more realistic conditions than currently available methods. Experimental data relating to endurance, wear, and traction are required to support the design of lunar wheels. This project is a significant component of a collaborative project between NASA, Clemson University, and industry to deliver mobility solutions for the manned US return to the moon in 2019.

Design Team

This project is undertaken by an all-female, interdisciplinary, undergraduate design team in collaboration with the aforementioned research group. The team is comprised of students ranging in class status from freshman to junior. The team members are mechanical and electrical engineering majors. The team is guided by a mechanical engineering graduate student coach and faculty advisor.

Design Approach

This long term design project is currently in the first of four phases. The first phase consists of the conceptual design of a means to test the durability, wear, and traction of non-pneumatic tires. This will include the use of design tools such as brainstorming, morphological charts, and decision matrices. The first phase will conclude with a preliminary design review. The subsequent stages are detailed design and sizing, construction, and experimental assessment of the testing device.

Design Deliverables

The ultimate project deliverables will include a written design report with full documentation of the conceptual development, physical prototypes, a patentable design, a fully-functioning device, and experimental validation. It is anticipated that the work presented at this conference will include a conceptual design complete with design requirements, benchmarking, concept exploration, and systems analysis; these are our phase one deliverables. The final deliverables are directly within the critical path of the larger project, so failure is not an option.

After all, it's just not cool to get stuck on the moon.

Eliminating Data Loss in a Foundry Wireless Sensor Network

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EXTENDED ABSTRACT

This paper outlines the development of a robust wireless transmission system for use in a wireless sensor network (WSN) application for an aluminum casting foundry. The focus is on 100% retrieval of sensor data. The lost foam casting technique is a method for casting intricate shapes from aluminum. A polystyrene mold is created in the desired shape and placed in a flask with a sprue attached. The mold is then covered with sand. When the molten aluminum is poured into the sprue, the hot metal melts away the foam and fills the mold. Casting defects can occur using the lost foam technique. Capacitance sensors were developed at TTU to provide a system for monitoring metal fill. Analysis of the sensor data can lead to understanding the parameters affecting casting defects and ultimately reduce or eliminate them. Due to safety hazards in the foundry, wireless transmission of sensor data was required. Mica2 Mote hardware was used to wirelessly transmit data from the capacitance sensors at the flask to a PC on the other side of the foundry. Analysis of sequencing numbers of the transmitted data packets showed that some packets were lost during transmission. Data loss increased as more motes were added to the system and when moved from the lab to the foundry. Incomplete data does not allow for complete analysis of the metal fill, so a system was developed to ensure 100% data retrieval. The Motes were programmed to log the sensor readings to their onboard memory as well as transmit them wirelessly. Each line of memory holds 8 sensor readings, so packet length was also chosen to hold 8 sensor readings. This system would allow missing data to be retrieved from the Motes' memory if initial wireless transmission failed. At the receiving PC, a LabView application was developed to interact with the sensor network. Much effort was invested in achieving successful communication between the 2 platforms. At the start, the PC application issues a start command packet to each Motes in the system. These command packets were offset to reduce channel contention for incoming data packets by providing discrete windows for each Mote to transmit. Eliminating channel contention reduced lost packets, but did not eliminate them entirely. The PC application parses and logs the incoming data packets to a file and keeps track of missing packets by examining the sequence numbers. When missing packets are detected, a command packet is sent to the appropriate mote to read the corresponding line of memory and retransmit a packet containing the missing data. A log of missing packet numbers is kept in case the retransmit is unsuccessful. When the stop button is pressed, stop command packets are sent to the Motes. All remaining missing data are requested again. Using this system, 100% of data was successfully retrieved. The system is limited by the circular buffer structure of the Motes' onboard memory. When the buffer is full, the earliest data is overwritten. Using the sample rate suggested by developers of the capacitance sensor, the duration of most metal pours was shorter than the limit imposed by the memory size. Refinement of the starting mechanism to avoid dropped start commands is needed, as well as testing during live metal pours. This system was successful at ensuring 100% retrieval of sensor data in the foundry.

A Real Time DSP Learning Module

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EXTENDED ABSTRACT

Purpose

Typically, digital signal processing (DSP) or signals and systems classes use text based programming languages (e.g. MATLAB), which do not use real time examples, as a lab type component for teaching difficult concepts that are vital parts of the course. Using this type of approach can result in students not grasping the materials as well as they possibly could. A real time, interactive approach could lead to achieving a better understanding of these difficult concepts. This project designs and creates a real time learning module to assist students in learning DSP.

Project

In order to create a real time environment, this project uses National Instruments LabVIEW 8.5 (a graphical programming environment) with DSP Module 2.5 and the National Instruments SPEEDY-33 external DSP board. This version of LabVIEW introduces a MIDI (Musical Instrument Digital Interface) read function. MIDI is a standard file type for digitalized music. The MIDI read function will instantaneously read in data from a MIDI file as an array of five frequency values. A program is constructed using the MIDI read function and implemented on top of the SPEEDY-33 board. This program splits the array of five frequency values into five separate arrays of frequencies, and plots each onto amplitude vs. time graph and amplitude vs. frequency graphs. The program then adds the separate arrays back into one array, recreating the original wave, and plots this array onto amplitude vs. time and amplitude vs. frequency graphs. This allows a visual representation of each voice that is being read from the MIDI file as well as a visual representation of the MIDI as a whole. With a reconstructed signal, the program then implements DSP including equalization, delay, reverberation, and synthesis. The program then outputs the signal with any, all, or none of the aforementioned effects to speakers. This provides a real time, interactive learning module to accompany coursework and math concepts, which can assist students in learning DSP or signals and systems concepts.

Results

Graphical programming languages (e.g. LabVIEW) are easier than text based languages to implement complex programs on, because they make use of function blocks wired to other functions, outputs, or graphs. Using the MIDI read function allows for a real time environment to work with. This real time environment makes learning concepts easier for students, because it appeals to senses. This immediate feedback in the form of seeing and hearing helps students in grasping the concepts of DSP.

A Study of the behavior of magnetite nanoparticles coated with fluorescent-thermoresponsive polymers for Magnetic Fluid Hyperthermia (MFH)

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EXTENDED ABSTRACT

Magnetic fluid hyperthermia (MFH) is a cancer therapy in which magnetic nanoparticles are delivered to a cancer tumor and an oscillating magnetic field is applied, resulting on in tumor death due to a localized temperature increase. We have synthesized magnetite (Fe3O4) nanoparticles using the co-precipitation method and grafted with 3-(trimethoxysily)propyl methacrylate (MPS) as surfactanton the particle surface. The nanoparticles were coated with N-isopropylacrylamide (NIPAM) through free radical polymerization in the presence of α,α'-azobisisobutyronitrile (AIBN) initiator, and a fluorescent modified acrylamide monomer (FMA). Poly-NIPAM in aqueous solution undergoes a phase transition at approximately 32˚C; this property in addition to the fluorescence properties of FMA, givethis property, in addition to the fluorescence properties of FMA, gives the nanoparticles the potential to work as magnetic fluorescent-thermometers. These magnetite nanoparticles respond to an external AC magnetic field by energy dissipation. Through the combination of these three properties, the particles could be used as nano-magnetic fluorescent-thermometers to follow temperature increase during MFH applications. Measurements of the hydrodynamic size and fluorescence response of these as a function of temperature demonstrated a decrease in hydrodynamic size of the nanoparticles close to the LCST transition, coupled to an increase in fluorescence intensity. Thermo Gravimetric Analysiszer (TGA) was used to determine the amount of MPS grafted onto the magnetite nanoparticle surface by weight loss percentage. A tTransmission electron microscope microscopy (TEM) was used to determine the size of the synthesized nanoparticle coress and an average particle diameter of 12 nm was obtained. Measurements of the hydrodynamic size and fluorescence response of these as a function of temperature demonstrated a decrease in hydrodynamic size of the nanoparticles close to the LCST transition, coupled to an increase in fluorescence intensity.