ASEE SOUTHEASTERN SECTION ANNUAL CONFERENCE

APRIL 1 - 3, 2012

The Global Reach of Engineering

Mississippi State University
Starkville, MS

Proceedings Editor: Barbara Bernal
Southern Polytechnic State University

Technical Program Chair: Tyson Hall
Southern Adventist University

Site Chair and Coordinator: John Brocato
Bagley College of Engineering
Mississippi State University

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* This abstract is a presentation only abstract without a full manuscript in the conference proceedings.

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CHAPTER 1 CONFERENCE INFORMATION

University Welcome

April1, 2012

Dear 2012 ASEE Southeastern Conference Attendees:

On behalf of the faculty, staff, and students of the James Worth Bagley College of Engineering at Mississippi State University, I welcome you to the 2012 American Society for Engineering Education Southeastern Section Annual Conference. We are excited about having you visit our campus.

The Bagley College prides itself on providing a comprehensive education for all of its students, instilling not only technical expertise but also highly effective communication skills, sharp entrepreneurial acumen, and a keen awareness of the engineering world outside the classroom windows via K-12 outreach and international Study Abroad opportunities. Indeed, to us, this year's conference theme – The Global Reach of Engineering – pertains as much to the "global" notion of educating the whole engineer as it does to a cultural exchange program with Italy or a collaborative public-works project in Bangladesh.

April is a wonderful time to visit Mississippi. MSU has one of the greenest and most beautiful campuses you will ever see anywhere. Its sprawling Barnes & Noble campus bookstore and MSU Cheese Store are excellent places to buy MSU souvenirs and memorabilia (including delicious MSU-made cheese, of course). The Charles Templeton Ragtime Museum and the John Grisham Room, both housed in MSU's Mitchell Memorial Library, are must-see on-campus attractions. Starkville's historic Old Main downtown district is a five-minute drive from campus and hosts a variety of wonderful local shops and restaurants, while attendees with a little more time to spare will love nearby West Point's Waverly Mansion Plantation or Columbus's Tennessee Williams Home.

I very much hope you enjoy your stay here in Starkville and Mississippi State, and if I can help you in any way during your time here, please let me know. Again, we are absolutely delighted to have you here.

Best,

Sarah A. Rajala

Sarah A. Rajala, Ph.D.
Dean and Professor
James Worth Bagley College of Engineering

Conference Welcome

Brent Jenkins, ASEE SE Section President

Welcome to the 2012 ASEE Southeastern Section Conference. This year's theme—*The Global Reach of Engineering*—emphasizes the global horizons and impact of engineering education. Our host committee, authors, and officers have devoted much effort to make this a memorable event. The pre-conference workshops, the keynote address, the presentations and discussions in the technical sessions, the peer-reviewed papers in the Proceedings, the student poster session, and the conversations during meals and breaks will provide you with numerous opportunities for professional growth and relationship building.

The Southeastern Section has a history of well-attended conferences and engaged, active members. Our breakfast meetings are excellent forums in which to join a discussion with colleagues having similar interests. The divisions that meet during Monday's breakfast are cross-disciplinary special interest groups such as *Instructional* and *Administrative*, while the divisions that meet during Tuesday's breakfast are discipline-specific groups such as *Civil Engineering*. Participation in these meetings is the first step toward becoming involved in the leadership of the Section.

This conference is the combined effort of many dedicated people. Each of us owes a debt of gratitude to: the host-site committee; the sponsors; the keynote speaker; the Technical Program Chair; the division chairs and manuscript reviewers; the authors and officers who contributed content and prepared the Book of Abstracts and the Proceedings; the presenters and moderators in the technical sessions; the awards committee; the workshop coordinator and leaders; the executive board; and the students, faculty advisors, and officers associated with the poster session.

Our 2013 conference will be hosted by Tennessee Technological University. Please see the included Call for Papers for details.

The Southeastern Section is a very special "place" (i.e., community) because of its members: those who preceded us, those who are active today, and those who will follow. Some of our most active leaders have moved away, passed away, or taken retirements. It is my sincere hope that the legacy we leave will compare favorably to the one they left to us.

If you are actively supporting Section activities, please continue; if you are a newcomer, please help us to make the Section and its conferences even better—we can always use a few more talented authors and officers. Thanks for coming, and I hope you have a great experience—both professionally and socially—at this conference and the ones to come.

Brent Jenkins
President, ASEE-SE

Acknowledgements

The planning and execution of any conference such as this involves the dedication and hard work of many, many people. I want to express my sincerest thanks to the following people:

- The over 130 registered conference attendees representing over 40 higher education institutions and 10 companies/institutions
- All the students in the poster competition
- All the presenters in the technical sessions
- The session moderators
- Dean Sarah Rajala for her leadership and guidance
- Michael Lane in the Dean of Engineering's Office for his expertise and hard work in coordinating the registration website
- All my fellow conference planners: Amy Barton, Ed Dechert, Donna Reese, Priscilla Hill, Rebecca Toghiani, B.K. Hodge
- Brenda Grebner and Debbie Stafford in the Dean's Office for their enormous help with all kinds of conference logistics
- The Dean of Engineering Business Office for their hard work and financial acumen: Sandra Reynolds, Dee Newell, Carol Martin
- The Bagley College of Engineering Publications Office, namely Todd Dickey and Heather Rowe, for their hard work with conference publicity, the conference memento, and the program/book of abstracts

I would especially like to thank Lydia Allison for her tireless efforts in securing and working with our conference sponsors, below:

Lockheed
Weyerhauser
Armfield
Virginia Tech Department of Engineering Education
Chevron
Stark Aerospace
Bomgar
Barnes & Noble

It has been a pleasure to serve you over the last year. If I can do anything at all for you during the conference, just let me know. Enjoy the conference and enjoy Mississippi State.

John Brocato
Site Coordinator

Conference Information

Sunday Reception

Sunday, April 1, 6:00-9:00 PM

Raspet Flight Research Laboratory
114 Airport Road
Starkville, MS 39759
http://www.raspet.msstate.edu/

**A bus will leave from the Comfort Suites Hotel at 5:30 PM to take attendees to the reception.*

Join us as we open the ASEE-SE 2012 Conference with a welcome reception at Mississippi State's Raspet Flight Research Laboratory. Raspet has plenty of wide-open space to visit with your fellow conference-goers while also perusing the largest and finest equipped university flight research facility in the country. We'll have a buffet-style dinner and an open bar, and students from some of the Bagley College's student research teams will discuss and conduct demonstrations for their current projects. Teams scheduled for the reception include…

ASE: Space Cowboys and Team Xipiter
ECE: Senior Design 2 teams
ChE: First-Year and Chem-e-Car teams
CEE: Steel Bridge, Concrete Canoe, ITE, EWB
ME: E-bike team, Human Powered Vehicle team, Old Guard Competition team

Conference Sponsors

Lockheed
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Conference Overview

Transportation will be provided between the Comfort Suites Hotel, Hampton Inn, Hilton Garden Inn, and locations of events

Sunday, April 1, 2012

Noon – 7:00pm	Conference Registration	McCain Hall foyer
10:00am – 2:30pm	Workshop: Session 1	McCain Hall Room 185
Noon – 3:00pm	Workshop: Session 2	McCain Hall Room 100
Noon – 4:00pm	Workshop: Session 3	McCain Hall Room 105
3:30pm – 5:30pm	Executive Board Meeting	McCain Hall Dunn Conference Room
4:30 – 5:15pm	CAVS Tour	McCain Hall bus pick up
5:30pm – 8:30pm	Welcome Reception	Raspet Flight Research Laboratory-Comfort Suites bus pick up

Monday, April 2, 2012

7:30 – 8:30am	Conference Registration	Colvard Union
7:30 – 8:30am	Breakfast & Unit Meetings	Colvard Union Ballroom S & U
8:45 – 10:00am	Welcome & Keynote Address	Colvard Union Ballroom M
10:00 – 10:20am	Morning Break	Colvard Union
10:00am – noon	Student Poster Session	Colvard Union 2nd floor hall
10:20am – noon	Technical Session 1	Colvard Union
Noon – 1:30pm	Lunch and Presentation	Colvard Union Ballroom S & U
1:40 – 3:20pm	Technical Session 2	Colvard Union
3:20 – 3:40pm	Afternoon Break	Colvard Union
3:40 – 5:20pm	Technical Session 3	Colvard Union
6:00 – 9:00pm	Reception and Award Banquet	Hunter Henry Center

Tuesday, April 3, 2012

8:00 – 9:00am	Breakfast & Division Meetings	Colvard Union Ballroom S & U
9:20 – 10:20am	Technical Session 4	Colvard Union
10:20 – 10:40am	Break	Colvard Union
10:40 – noon	Technical Session 5	Colvard Union
Noon – 1:30pm	Lunch & Business Meeting	Colvard Union Ballroom S & U
1:30pm	Conference Adjourn	

Conference Technical Sessions at a Glance

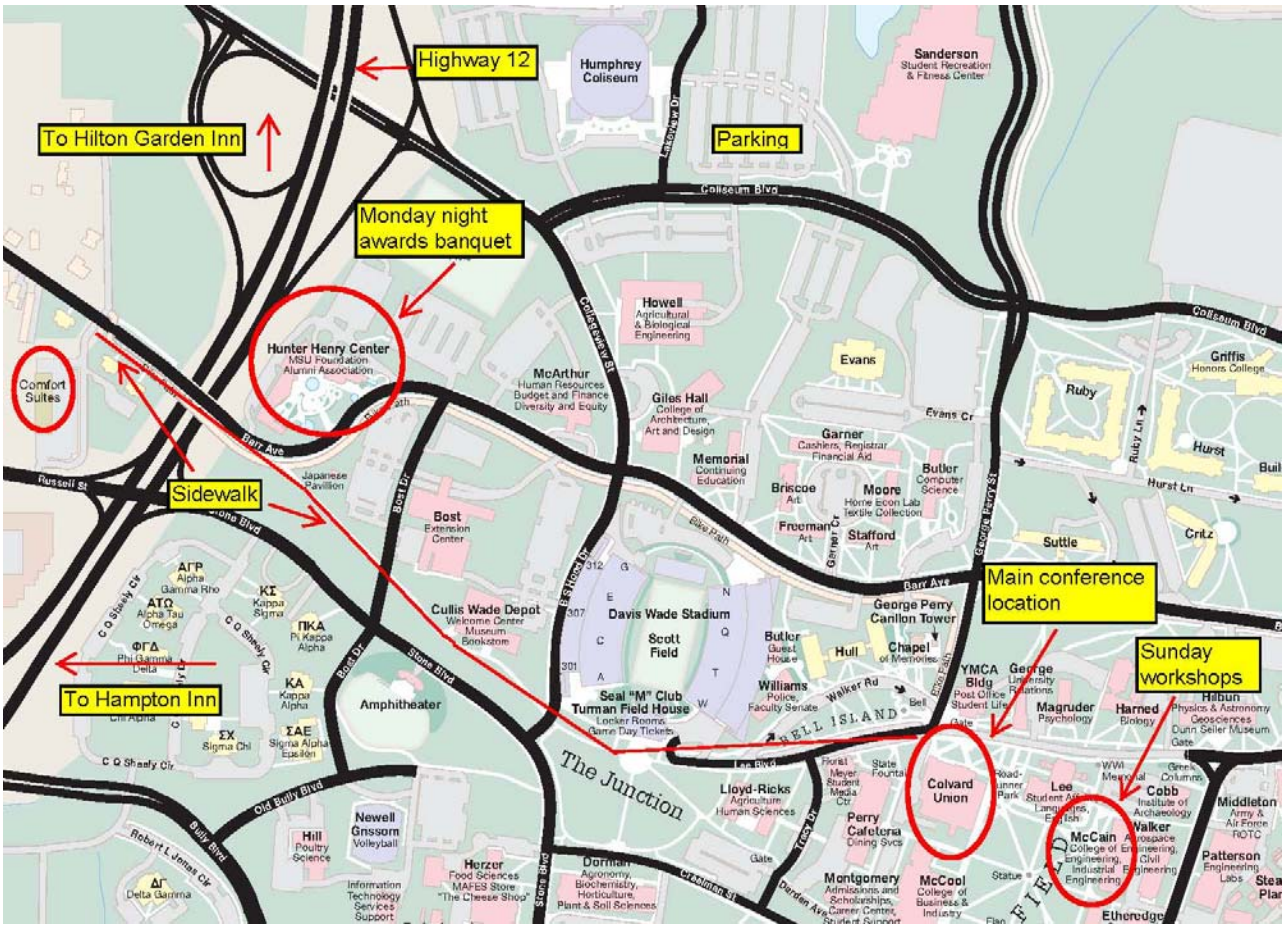
Monday, April 2, 2012

10:20 – 12:00 noon	T1-A Colvard Union 328	T1-B Colvard Union 329	T1-C Colvard Union 325	T1-D Colvard Union 330	T1-E Colvard Union 231
Technical Session 1	Instructional Division I	Administrative Division I	Chemical Engineering Division I	Civil Engineering Division I	Mechanical/Bio Engineering Labs
Moderator	*Ken Brannan*	*Cecelia Wigal*	*Sirena Hargrove-Leak*	*Tulio Sulbaran*	*John Abbitt*
01:40 pm – 3:20 pm	**T2-A Colvard Union 328**	**T2-B Colvard Union 329**	**T2-C Colvard Union 325**	**T2-D Colvard Union 330**	**T2-E Colvard Union 231**
Technical Session 2	Instructional Division II	Administrative Division II	K-12 Division I	Computer Eng. and Technology Division	Mechanical Engineering Division
Moderator	*Joseph Coe*	*Paul Palazolo*	*Daniel Kohn*	*Ahmed Abukmail*	*Lulu Sun*
03:20 pm – 03:40 pm	**Afternoon Break**				
03:40 pm – 05:20 pm	**T3-A Colvard Union 328**	**T3-B Colvard Union 329**	**T3-C Colvard Union 325**	**T3-D Colvard Union 330**	**T3-E Colvard Union 231**
Technical Session 3	Instructional Division III	Engineering Technology Division	K-12 Division II	Civil Engineering Division II	Professional Skills Division
Moderator	*Claire McCullough*	*Jerry Newman*	*Beth Todd*	*Tanya Kunberger*	*Cindy Waters*

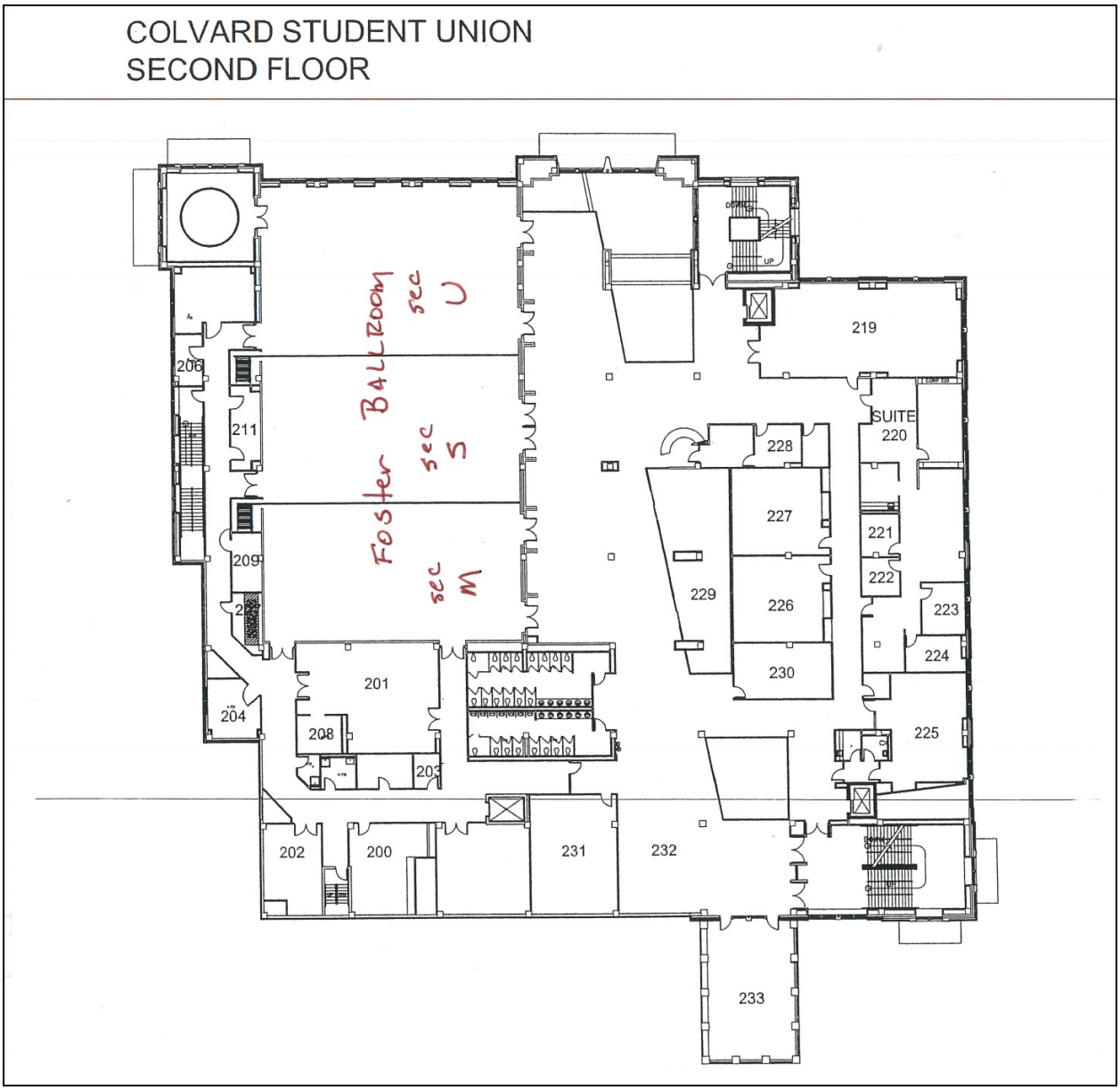
Tuesday, April 3, 2012

08:00 am – 09:00 am	**Breakfast and Division / Unit Meetings**				
9:20 am – 10:20 am	**T4-A Colvard Union 328**	**T4-B Colvard Union 329**	**T4-C Colvard Union 325**	**T4-D Colvard Union 330**	**T4-E Colvard Union 231**
Technical Session 4	Service Learning	Electrical Engineering Division	Chemical Engineering Division II	Software Engineering Division I	ASEE: Year of Dialog
Moderator	*Sally Pardue*	*Zhaoxian Zhou*	*R. Mark Bricka*	*Donna Reese*	*Doug Tougaw*
10:20 am – 10:40 am	**Morning Break**				
10:40 am – 12:00 noon	**T5-A Colvard Union 328**	**T5-B Colvard Union 329**	**T5-C Colvard Union 325**	**T5-D Colvard Union 330**	
Technical Session 5	Instructional Division IV	Administrative Division III	Research Division	Software Engineering Division II	
Moderator	*Tim Wilson*	*Priscilla Hill*	*Tom Fallon*	*Willard Munger*	

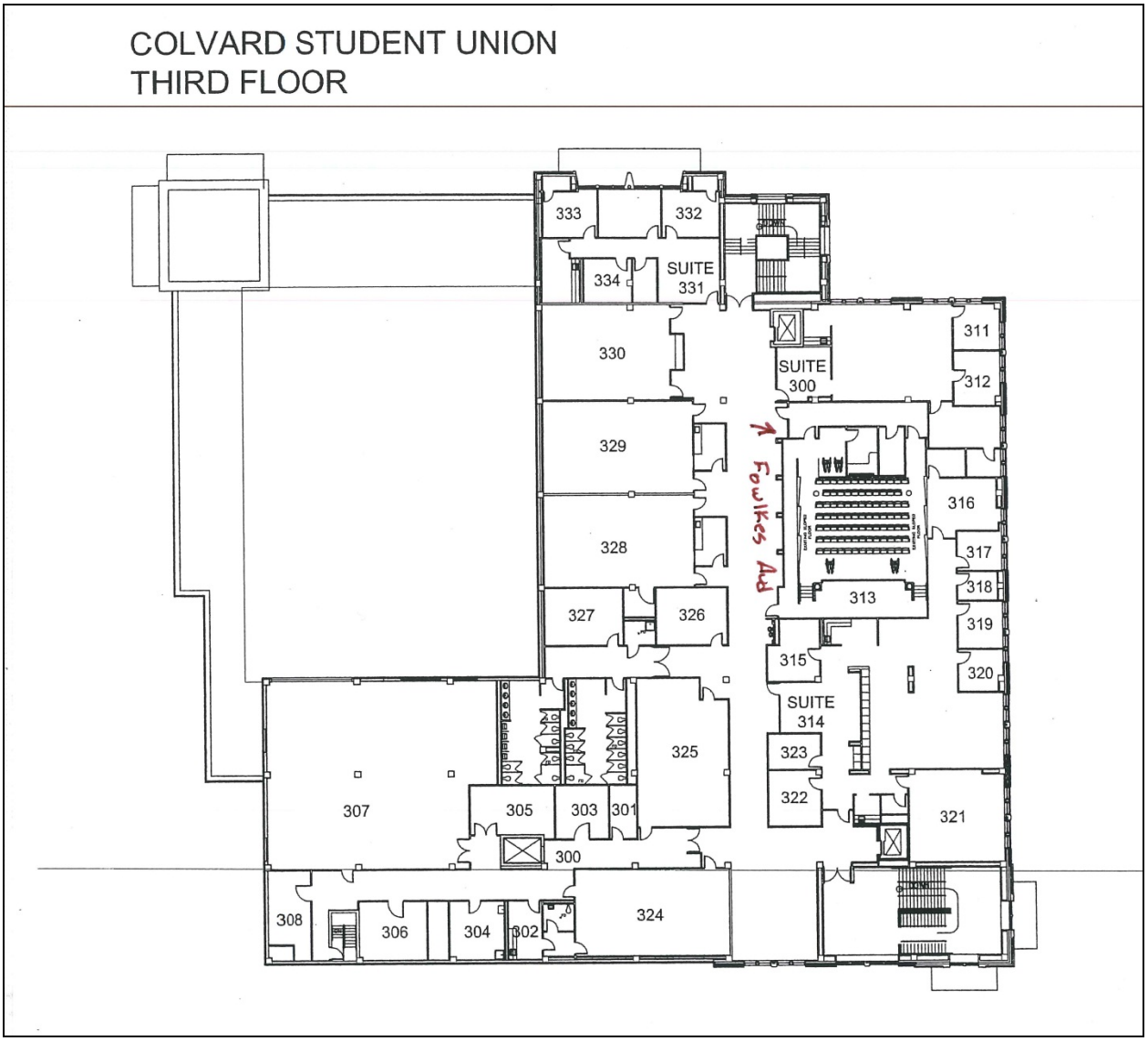
Mississippi State University Campus Map



Colvard Union Map (2nd Floor)



Colvard Union Map (3nd Floor)



Technical Session Information

Session and Presentation Timing

Sessions are scheduled for 5, 4, or 3 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 3 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 T1	Session T2	Session T3	Session T4	Session T5
Presentation #1	10:20	1:40	3:40	9:20	10:40
Presentation #2	10:40	2:00	4:00	9:40	11:00
Presentation #3	11:00	2:20	4:20	10:00	11:20
Presentation #4	11:20	2:40	4:40		11:40
Presentation #5	11:40	3:00	5:00		

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.

Conference Workshops

All workshops will be held in McCain Hall on the MSU campus and will include food and beverages.

Workshop 1
Title: Developing the NAE-2020 Engineer (The Composer- vs. the Conductor-Style Engineer)
Presenters: J. R. Sanders and P. E. Arce (Tennessee Tech University)
McCain Hall, Room 185; 10:00 a.m.–2:30 p.m.

Fee: $15

This workshop will be conducted with audience collaboration and dynamic participation. Key objectives include the following:

- Description of the Characteristics of the NAE 2020 Engineering Model
- Introduction to the pedagogical driving principles behind the model
- Introduction of the key cycles in acquiring learning based on collaborative approaches: Legacy Cycle and Documentation Cycle
- Introduction of key components of innovative and creative approaches within a Group Genius Approach
- Elements of the Linear Engineering Sequence and its role in the transfer of knowledge with the purpose of innovation assessment of the different aspects involved within the methodology
- Feedback for participants interested in applying the approach.

Workshop 2
Title: Highlights of the ASCE Excellence in Civil Engineering Education (ExCEEd) Workshop
Presenters: Tanya Kunberger and Robert O'Neill (Florida Gulf Coast University)
McCain Hall, Room 100; 12:00–3:00 p.m.

Fee: $25

This workshop will highlight some of the key points of the American Society of Civil Engineering's week-long ExCEEd Teaching Workshop through a combination of presentations, group discussions, and small team activities. Presentations will provide background information, while group discussion will expand on proposed concepts and team activities will apply these ideas to the participants' specific course. Upon completion of this workshop, participants will be able to: 1) describe aspects of a model instructional strategy that can be utilized in the engineering classroom to increase student engagement and enhance student learning, 2) identify various learning styles and how to teach to multiple styles within a single class, and 3) apply various organizational and instructional techniques to develop intellectual excitement and foster interpersonal rapport both in and out of the classroom.

Workshop 3
Title: Developing Spreadsheet-Based Decision Support Systems
Presenter: Sandra D. Eksioglu (Mississippi State University)
McCain Hall, Room 105; 12:00–4:00 p.m.

Fee: $15

Decision support systems (DSS) are used to support complex decision making and problem solving. A DSS uses problem-specific, quantitative and knowledge-based models to analyze data residing in spreadsheets and/or databases. A DSS assists the user in the decision-making process through a graphical user interface. The need to teach DSS development skills to industrial engineering, operations research and business school students has been felt by many universities due to increase popularity of DSS in business and management. Our students are frequently being employed in positions that require developing DSS. Indeed, imparting DSS development skills, which combine OR skills with IT skills, will make students highly sought after in the modern workplace.

Workshop participants will learn about some of Excel extended functionalities and VBA for Excel. They will also learn about using Risk Solver Platform (RSP) to solve mathematical programs and perform Monte Carlo simulation. Finally, they will learn how to use these tools in order to build a DSS in Excel. We will provide some guidance on how to use this material in courses that teach students about building DSS. The workshop is based on the 2nd edition of the textbook *Developing Spreadsheet-Based Decision Support Systems*, which is published by Dynamic Ideas. We will provide about 15 case studies on developing DSS, PowerPoint presentations for the entire course material and the workshop, examples for entire course and workshop material, and over 25 team projects for students to build DSS. In this workshop, participants will get an excellent jump-start to offer a full course on developing a spreadsheet-based DSS or adding some of the material to the existing spreadsheet modeling courses.

Keynote Speaker

Dr. Howard G. Adams, Ph.D.
Founder and President, H.G. Adams & Associates, Inc.

Educator, consultant, and author, Howard G. Adams was born on March 28, 1940 in Pittsylvania County, Virginia to Delsia Mae Waller Adams and Daniel Boone Adams. As a child, he helped his father on the family farm and enjoyed exploring nature. Adams attended Southside High School, Blairs, VA. During high school, he worked after-school as a kitchen helper at the Greyhound bus station in Danville, Virginia. In 1958, Adams graduated from high school, and then moved Paterson, New Jersey to escape from the segregated south. In 1959, Adams enrolled at the Norfolk Division of Virginia State College (now Norfolk State University) where he majored in biology. In order to finance his education, Adams worked at a supermarket and, during his senior year, at a fast food restaurant. Adams was active on campus, serving as Cadet Captain in the ROTC Military Science Program, president of the sophomore and senior classes, president of the biology club, and vice president of the student government association. He received his B.S. degree in biology from Norfolk State College in 1964.

That same year, Adams began his professional career as a general science teacher at Jacox Junior High School in the Norfolk City Schools System. He also received his M.S. degree in biology from Virginia State College (now Virginia State University) in 1968 as a National Science Foundation In-Service Fellow. In 1970, Norfolk State University President Lyman Beecher Brooks recruited Adams to serve as the school's first director of alumni affairs. After three years in that position, he was promoted to vice president for student affairs at Norfolk State University. Adams also enrolled in Syracuse University's higher education administration program, receiving his Ph.D. degree in 1978. Adams then accepted the position of executive director of the National Consortium for Graduate Degrees for Minorities in Engineering and Science, Inc. He held the position until 1995, when he founded his consulting company, H.G. Adams & Associates, Inc.

Adams has received numerous awards including the Centennial Medallion from the American Society of Engineering Education; named a 20th Century Outstanding Educator by Black Issues in Higher Education; and received the Golden Torch Award Lifetime Achievement in Academia from The National Society of Black Engineers. He was named by President Clinton as one of the first recipients of the Presidential Awards for Excellence in Science, Mathematics, Engineering and Mentoring. In addition, Adams is a board member of the American Association of Blacks in Higher Education and was a former faculty member of AABHE's Leadership and Mentoring Institute. He has written three books including his 2002 book *Get Up with Something on your Mind! Lessons for Navigating Life* and over fifteen self-help guides and handbooks. Adams is married to the Eloise Adams, Ph.D. and they have one daughter, Stephanie Glenn Adams, Ph.D.

2011-2012 ASEE-SE Officers' List

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ASEE Conference Participants 2012

First Name	Last Name	Institution
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Yosef	Allam	Embry-Riddle Aeronautical University
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Laurie	Garrow	Georgia Institute of Technology
Priya	Goeser	Armstrong Atlantic State University

Robert	Green	Mississippi State University
Sinjae	Hyun	Mercer University School of Engineering
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Sirena	Hargrove-Leak	Elon University
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BK	Hodge	Mississippi State University
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William	Janna	University of Memphis
Brent	Jenkins	Southern Polytechnic State University
Hodge	Jenkins	Mercer University
Dave	Johnstone	Virginia Military Institute
Bryan	Jones	Mississippi State University
Jason	Keith	Mississippi State University
Adeel	Khalid	Southern Polytechnic State University
Javed	Khan	Tuskegee University
Brenda	Kirkland	Mississippi State University
Daniel	Kohn	University of Memphis
Bob	Kolvoord	James Madison University
Nicholas	Kraft	University of Alabama
Tanya	Kunberger	Florida Gulf Coast University
Ellen	Lackey	University of Mississippi
Laura	Lackey	Mercer University School of Engineering
Sarah	Lee	Mississippi State University
Rogelio	Luck	Mississippi State University
Pedro	Mago	Mississippi State University
Susan	Major	University of Mississippi
Philip	McCreanor	Mercer University School of Engineering
Claire	McCullough	University of Tennessee at Chattanooga
Jean	Mohammadi-Aragh	Virginia Tech
Thomas	Morris	Mississippi State University
Thomas	Murphy	Armstrong Atlantic State University
Alice	Myatt	University of Mississippi
Oliver	Myers	Mississippi State University
Fazil	Najafi	University of Florida
Otsebele	Nare	Hampton University
Simin	Nasseri	Southern Polytechnic State University
Charles	Newhouse	Virginia Military Institute
Jerry	Newman	University of Memphis
Mason	Nixon	Georgia Institute of Technology
Maher	Omar	University of Sharjah
Danny	Overstreet	Knovel
Sean	Owens	Mississippi State University
Qing	Pang	Jackson State University

Bryan	Patton	Mississippi State University
Richard	Patton	Mississippi State University
Jose	Pichardo	Mississippi State University
Sarah	Rajala	Mississippi State University
Jeff	Ray	Southern Polytechnic State University
Donna	Reese	Mississippi State University
Joseph	Rencis	Tennessee Technological University
Larry	Richards	University of Virginia
Thaddeus	Roppel	Auburn University
Jeannette	Russ	Union University
Scott	Schiff	Clemson University
Judy	Schneider	Mississippi State University
Scott	Schultz	Mercer University
Randal	Schwindt	Union University
Atin	Sinha	Albany State University
Earl	Smith	Georgia Southern University
Randy	Smith	The University of Alabama
Levi	Smolin	Auburn University
Rebecca	Smolin	Auburn University
Sylvester	Stafford	Mississippi State University
Tonya	Stone	Mississippi State University
Lesley	Strawderman	Mississippi State University
Tulio	Sulbaran	University of Southern Mississippi
Rani W.	Sullivan	Mississippi State University
Lulu	Sun	Embry-Riddle Aeronautical University
Ken	Swayne	Pellissippi State Community College
Yan	Tang	Embry-Riddle Aeronautical University
Danielle	Thomas	Embry Riddle Aeronautical University
Danielle	Thomas	Embry Riddle Aeronautical University
Danielle	Thomas	Embry Riddle Aeronautical University
Beth	Todd	University of Alabama
Becky	Toghiani	Mississippi State University
Douglas	Tougaw	Valparaiso University
John	Usher	Mississippi State University
Angela	Verdell	Mississippi State University
Keith	Walters	Mississippi State University
Charles	Wasson	Wasson Strategics, LLC
Cynthia	Waters	North Carolina A&T State University
Taylor	Waters	Mississippi State University
Mary Katherine	Watson	Georgia Institute of Technology
Taylor	Weatherford	Western Kentucky University
Robert	Whalin	Jackson State University
Cecelia	Wigal	University of Tennessee at Chattanooga
Carl	Williams	University of Memphis

Timothy	Wilson	Embry-Riddle Aeronautical University
Katherine	Winters	Virginia Tech
Qiong	Zhang	University of South Florida
Zhaoxian	Zhou	University of Southern Mississippi

Call for 2013

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E4 Efficient Effective Engineering Education

In an era of declining resources and increasing curricular demands, engineering programs are challenged to do more with less. Accreditation requirements, industry concerns, emerging technologies, and contemporary topics such as sustainability, entrepreneurship, and humanitarian service demand time and resources in an already packed curriculum. How can we efficiently and effectively educate engineers in this environment?

CALL FOR PAPERS AND PRESENTATION ABSTRACTS

Authors are invited to submit full-length manuscripts for presentation at the conference and inclusion in its proceedings. Papers addressing the conference theme, **Efficient and Effective Engineering Education**, will have first priority and may include topics related to the following:

- Innovative Curricula or Courses
- First Year Engineering Programs
- Organizational Structures to Promote Interdisciplinary Engineering
- Engineering Common Cores
- Teaching/Learning Practices: Past, Present, and Future
- Distance Learning in Engineering
- Technologies for Efficient Learning
- Engineering K-12 Outreach Programs
- Engineering Learning Communities
- ABET Accreditation Projects
- Engineering Recruitment and Retention
- Partnerships
- Capstone Design Courses or Projects
- Engineering Professional Development

Authors may also address other topics of interest to the engineering education community. Guidelines for manuscript preparation are available via the Author Instructions link at www.asee-se.org/Conference/. Papers will be accepted based on a peer review of manuscripts. Authors are expected to present their papers at the conference to facilitate the transfer of knowledge through discussion and debate. All accepted papers presented by a timely-registered author will be included in the conference proceedings. A limited number of abstracts may be accepted for presentation. These abstracts will be published in the book of abstracts but will neither be peer-reviewed nor included in the conference proceedings. An author/co-author can be associated with as many papers/presentations as is appropriate, but a registrant can serve as the presenter of record on a maximum of three presentations. A poster session in which undergraduates discuss their experiences in engineering education (design projects, research, etc.) is anticipated. Information about this session will be available in the fall.

SCHEDULE FOR SUBMISSION OF PAPERS AND ABSTRACTS

Friday, September 28, 2012	Abstracts submitted by authors for consideration
Friday, October 5, 2012	Authors notified regarding acceptance
Monday, November 19, 2012	Manuscripts due from authors for review
Friday, December 21, 2012	Reviewed manuscripts returned to authors
Friday, January 18, 2013	Final manuscripts and extended abstracts due from authors
Friday, February 8, 2013	Deadline for presenters to register for conference

Submit a 250-300 word abstract in doc, docx, or pdf file format by September 28, 2012, to http://asee.spsu.edu/.

CONTACTS: Hodge Jenkins, Technical Program Chair, jenkins_he@mercer.edu; Steven Click, Conference Chair, sclick@tntech.edu

CHAPTER 2
TECHNICAL SESSION EXTENDED ABSTRACTS

Technical Session 1 Monday, April 2, 2012
10:20am – 12:00 noon

10:20 – 12:00 noon	T1-A Colvard Union 328	T1-B Colvard Union 329	T1-C Colvard Union 325	T1-D Colvard Union 330	T1-E Colvard Union 231
Technical Session 1	Instructional Division I	Administrative Division I	Chemical Eng. Division I	Civil Eng. Division I	Mechanical/Bio Eng. Labs
Moderator:	*Ken Brannan*	*Cecelia Wigal*	*Sirena Hargrove-Leak*	*Tulio Sulbaran*	*John Abbitt*

T1–A: Instructional Division I **Colvard Union 328**

507 - Modern Distance Education – Going Global While Staying Home 2-3
Adeel Khalid

601 - Distance Education for Engineering Technology: Faculty and Student Perspectives 2-4
Aaron K. Ball, William L. McDaniel

*596 ~~- Online instruction and strategies for higher education~~ Not Presented 2-5
Earl B. Smith, Deidre Paris, Cheryl D. Seals

521 - Teaching Methods – What Engineers can learn from Liberal Arts 2-6
Adeel Khalid

*513 - Design as the Spine: The New General Engineering Program at James Madison University 2-7
Bob Kolvoord

T1–B: Administrative Division I **Colvard Union 329**

525 - Challenges of Starting a New Aerospace Engineering Program at a Polytechnic University 2-8
Adeel Khalid

573 - A Program to Broaden Participation in Computing Majors 2-9
Donna S. Reese, Rodney Pearson, Robert Otondo, Julia Hodges, Bryan Jones

510 - University and community college collaboration in North Carolina 2-10
George Ford, William McDaniel, Aaron Ball

514 - "Wait ... There is a PhD in Engineering Education?": The First-Year Experience of Three Students in an Engineering Education Department 2-11
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520 - Increasing Participation of Women in Cyber Security 2-12
David A. Dampier, Kimberly Kelly, Kendra Carr

T1–C: Chemical Engineering Division I **Colvard Union 325**

T1–D: Civil Engineering Division I **Colvard Union 330**

T1–E: Mechanical/Biomedical Engineering Labs **Colvard Union 231**

507 - Modern Distance Education – Going Global While Staying Home

Adeel Khalid

Southern Polytechnic State University

EXTENDED ABSTRACT

With the modern advances in computer and network technology, it is now possible to teach a live online distance-learning course from anywhere around the world. The need for the instructor and the students to be physically present in a common classroom is eliminated. In an on-line course, students and teacher get the opportunity to interact with each other. The computer-based distance learning approach is still in its relative infancy. But since the teaching and learning is done online, via the use of computers connected to inter-connected networks and satellites, the need to be geographically co-located does not exist any longer. The instructor and the students can be physically distributed at various locations, around the city, around the country, or around the world and still be able to teach and learn from each other as if they were present together in the same classroom. Since the medium of instruction is computers, the instructors and students can be outsourced. The flip side of the argument is that since the instructor is not physically present in the same room with the students, they do not get to interact with each other face to face. The instructor can continue to derive a complex mathematical equation without realizing that a student has walked away from their computer. This paper explores the positives and negatives of distance learning distributed education. Advantages and disadvantages of DL are discussed and a few solutions to the challenges, experienced by the instructors, are addressed.

The research is based on the author's experience of teaching online courses from within the city, across the states, and finally across the continents. Amongst other findings, the author discovered that when teaching an online distance learning class, distance is not a factor. While teaching online classes, the author travelled across different cities, states, and internationally and the students did not realize that the instructor was out of town and could not meet with them in the office after class.

601 - Distance Education for Engineering Technology: Faculty and Student Perspectives

Aaron K. Ball and William L. McDaniel

Western Carolina University

EXTENDED ABSTRACT

A multitude of computer-based educational approaches exists and are touted to revolutionize the teaching and learning process in distance education. Whether as a stand alone mode, online, offline, synchronous, asynchronous, virtual reality or any hybrid model, educational technology has grown to consume both the teacher and student. Technology has transformed our lives to the point where the work load and expectations often cloud the foundational pedagogy, theoretical backbone, and applied engineering fundamentals for both students and faculty in distance education. Has the emphasis grown to embrace the method of delivery over the content and competency of the student and teach? This paper will present a "guide" for distance education from both the student and faculty perspectives. Curriculum issues, methods of delivery, evaluation, and assessment of teaching and learning will be emphasized.

*596 – Not Presented

521 Teaching Methods – What Engineers can learn from Liberal Arts

Adeel Khalid

Southern Polytechnic State University

EXTENDED ABSTRACT

The purpose of this project is to identify a few key active learning techniques that are effective for students in liberal arts and analyze whether they have the same effectiveness when used in undergraduate engineering classes. The focus of this study is on active student-centered teaching and learning strategies. The active learning techniques are inspired from a variety of disciplines including mathematics, language, arts, and law. A few of the techniques are summarized and compared across disciplines in table 1.

Table 1: *Comparison of active learning techniques across disciplines*

	Engineering	Mathematics	Languages	Arts	Law
Muddiest Point / Clarification Pause	X	X	X		
Group Quizzes	X	X	X		
Use of Props	X		X		
Incentives (Candy Questions)	X		X		
Mind Breaks	X		X		
Ownership of class	X		X		
Evaluate each other's work		X	X	X	
Cooperative Groups	X	X	X		
Student Generated Content		X	X		X
Changing Seating arrangement			X		
Student Polling			X		X
Debates			X		X

The goal is to map these across disciplines to qualitatively and quantitatively explore and identify which techniques work best in general for engineering undergraduate students. The end result will be the identification of the top few techniques applicable to engineering students.

*513 - Design as the Spine: The New General Engineering Program at James Madison University

Bob Kolvoord

James Madison University

In the many national conversations about the reform of undergraduate engineering education, a focus on systems thinking, sustainability and design has emerged, highlighting crucial elements for engineering practice in the new century. The synthetic nature of engineering requires the integration of these elements in order to be successful in meeting the increasingly complex challenges of the world in which we live. Engineers must also be mindful of the social context in which the problems they address reside. The question is how to do this in the context of an undergraduate engineering curriculum.

At James Madison University (JMU), we have created a new General Engineering program where we attempt to connect the themes of sustainability, systems thinking and design through a focus on design as the spine of our curriculum. At JMU, engineering students pursue a seven semester design sequence that integrates concepts of sustainability and social context with the more traditional tools and content of design coursework. From their first year "Introduction to Engineering" class through their four semester capstone design project, we work with students to help them master key content about design and sustainability, set in a problem-based learning environment.

Our vision for the design sequence is to use a variety of pedagogical approaches to teach problem solving (including group and independent, structured and unstructured, directed and non-directed), and to engage students in the process of design. We aim to find a balance between theory and practice, and between quantitative and qualitative reasoning, We also develop students' design knowledge, systems thinking skills, understanding of the different contexts of sustainability, ethical knowledge through an iterative process across the sequence of courses. We focus on project management and professional skills/behavior, including effective communication. We have a strong emphasis on group work across the entire curriculum.

The design sequence includes the following courses:

Introduction to Engineering (ENGR 112 – Freshman year)

This class includes modules to introduce students to design through both reverse engineering and new design activities. Students develop basic knowledge about the design process and appropriate design tools.

Design I and Design II (ENGR 231 and 232 – Sophomore year)

These classes focus on the design and construction of a pedaled vehicle for a user with a physical disability. Working with a client, students apply the design process to generate a number of pedaled vehicle design that meet the client's specific needs. They then build a prototype for the client and the client choses the best prototype for their needs.

Design III and Design IV (ENGR 331 and 332 – Junior year)

Design V and Design VI (ENGR 431 and 432 – Senior year)

In the final four design courses, students pursue a two-year capstone design project. In the first semester, they engage in planning and conceptualization with the project of their choosing. They follow up with modeling and prototyping in the second semester. In their senior year, they complete prototyping and begin testing and evaluation. They finish the sequence with evaluation, redesign and production.

These capstone projects focus on real-world challenges and range from the design of a sustainable health clinic in Africa to using biomimicry to inform the aerodynamics of freight trailers to the construction of a DNA printer.

In each of the classes, we integrate the four pillars of sustainability (technical, economic, environment, and society) with the theory and practice of design. Students produce a variety of deliverables, such as a system requirement review, preliminary design review, critical design review, testing readiness review, and production readiness review. We are also carefully assessing student outcomes at each stage of the design coursework.

In this session, we'll report on the initial implementation of this new curriculum and share details of the design courses. We'll report on successes and challenges to date and share our vision for advancing this unique curriculum past the start-up phase.

525 - Challenges of Starting a New Aerospace Engineering Program at a Polytechnic University

Adeel Khalid

Southern Polytechnic State University

EXTENDED ABSTRACT

The purpose of this paper is to describe a few challenges faced with starting a new Aerospace Engineering program at Southern Polytechnic State University, which is a predominantly undergraduate engineering university. The challenge is not that engineering basics do not exist, but on the contrary, the challenge is that several disciplinary engineering programs already exist at the university. These include engineering and engineering technology programs. Several duplicate majors exist within both programs including mechanical engineering and mechanical engineering technology, electrical engineering and electrical engineering technology etc. Overall, there are currently more than a dozen disciplines offered within the school of engineering and engineering technology. This poses a unique challenge in terms of starting yet another engineering program. The challenge for Aerospace Engineering programs, like in other STEM (Science, Technology, Engineering, and Mathematics) disciplines is that there are fewer and fewer young people interested in entering this field. However the bottom line is that aerospace engineering is one of the fundamental disciplines that need to exist and flourish. One of the mankind's greatest accomplishments is the ability to create vehicles that provide the ease, comfort, and timeliness of long distance travels that is affordable and safe. The need to design, develop, and produce safer, more economical aerospace vehicles will continue to exist. It is hard to imagine going back to any other mode of transportation for inter-continental and other long distance travels. In the author's opinion, the aerospace industry is expected to bounce back from its current trough – so it is important to develop new programs and train future engineers who will continue to further develop and push the science to the next level. In this paper, the author discusses the need for another aerospace program, the initiatives, the challenges and how these can be overcome.

573 - A Program to Broaden Participation in Computing Majors

Donna S. Reese, Rodney Pearson, Robert Otondo, Julia Hodges, Bryan Jones

Mississippi State University

EXTENDED ABSTRACT

Mississippi State University (MSU), like many other institutions across the country, has seen a significant decline in the number of computing majors since the early 2000's when the Dot Com crash caused many students to shy away from majors involving computing. In addition, the diversity of the students who have remained in the field has decreased, particularly with female students making up a smaller and smaller percentage of majors in these fields. Underrepresented minorities also tend not to be well represented. MSU's computing departments (Management and Information Systems, Computer Science and Engineering, and Electrical and Computer Engineering) combined forces in 2010 to propose an NSF funded Broadening Participation in Computing program that would work with the state's large community college system to recruit more students into these computing related majors at MSU. This program received funding in the spring of 2010 and has run two successful Summer Computing Experience programs for this targeted group.

The Summer Computing Experience program aims to attract students from Mississippi's community colleges to come to MSU for the first term each summer. The program offers students six hours of credit in computing related courses and exposes them to life at MSU. With the provided NSF funding, students have their housing, tuition and meals paid for and receive a small stipend to help offset any earnings the student could have accrued through working during this period.

The two classes students take include an iPhone programming class for beginners (assumes no prior programming experience) and a Leadership in Computing class that covers current topics in computing, career opportunities for computing majors, introduction to university services, and a group project involving either iPhone or Scratch programming.

This paper addresses the specifics of this program including the recruitment of students, specifics of the two classes involved, and assessments completed to date to determine the effectiveness of this program. Assessments have included a pre- and post- attitudinal survey, formative assessments relative to each summer's program and an ongoing qualitative study to determine the barriers that community college students face on transition to four-year schools.

510 - University and community college collaboration in North Carolina

George Ford, William McDaniel, and Aaron Ball

EXTENDED ABSTRACT

The North Carolina Community College System (NCCCS) operates 58 colleges which serve over 850,000 students. According to the System website, one in eight of the state's residents enrolled in one or more of their programs last year. Western Carolina University is a regional, comprehensive university and is located in Cullowhee, North Carolina, about 45 miles west of Asheville. There are about 9400 fulltime, undergraduate students attending the University. Western Carolina University is a member of the University of North Carolina system.

The Kimmel School of Construction Management and Technology at Western Carolina University offers programs in engineering technology, electrical engineering and construction management. According to their mission statement Western Carolina University creates engaged learning opportunities that incorporate teaching, research and service through distance education. In addition to supporting the mission of the University, the faculty in the Kimmel School recognize the value of distance education and collaboration in the creation of student contact hours to support on-campus programs.

The Kimmel School works in cooperation with regional community colleges in the state by providing an engineering technology program specifically tailored for working professionals who complete two-year technology programs at the community college and by maintaining relationships with community college faculty through research collaboration and recruiting and student advising activities. This paper provides details on the activities performed by Kimmel School faculty in concert with community college faculty to provide opportunities for students to continue their education after completing their two-year degree.

Keywords: community college university collaboration, articulation agreements, advising,

recruiting

514 - "Wait … There is a Ph.D. in Engineering Education?" The First Year Experience of Three Students in an Engineering Education Department

Rachel A. Louis, Mahnas J. Mohammadi-Aragh, and Walter C. Lee

Virginia Tech

EXTENDED ABSTRACT

As engineering education continues to expand, so does the number of students receiving doctorates in the field. While engineering education programs are being actively developed, little is known about how students are experiencing these programs. This paper explores the first year experience of three students currently enrolled in an engineering education doctoral program. Each student attends the same program and varies in terms of their pre-entry attributes and goals. This paper is a first step towards better understanding the graduate student experience in engineering education so that more work can be done related to students' institutional experiences in the field.

Methods

We adopted an autoethnographic approach using qualitative research methods. Each researcher reflected in writing on their entry into the field and their experience as a first year doctoral student in engineering education. While the results of this work are from the perspective of the authors, a systematic process was used to collect and analyze the data. The narrative questions that each research answered were as follows:

1) Why did you decide to pursue a degree in engineering education?
2) What were your pre-entry attributes?
3) What were your initial goals and commitments?
4) What was your first year institutional experience?
5) How have your goals and commitments changed since you first started the program?

Once the prompt questions were answered, we analyzed the narratives looking for overall themes and trends.

Conclusions

This study and reflection of our first year experiences in an engineering education program provided many benefits. It is our hope that the themes, patterns, and ideas presented in this paper will impact future engineering education community members. For administrators interested in recruiting potential engineering education students, it is important to advertise the field more and to consider a student's social integration when they are beginning your program. For students interested in enrolling in an engineering education program, it is important to consider what is important to you in an engineering education program, to participate in social activities with other engineering education students, and to take control of your future.

520 - Increasing Participation of Women in Cyber Security

David A. Dampier, Kimberly Kelly, Kendra Carr

Center for Computer Security Research, Mississippi State University

EXTENDED ABSTRACT

Over half of the population in the United States is women, yet less than 20% of the students who study computing in this country are women? Why is that? Worse, much less than 20% of women study computer security, and it is one of the most important subjects of our time. In 2010, Mississippi State University (MSU) began a project to try and change the attitudes of women in Mississippi toward computing in general, but more specifically about computer security as a career path. The problem is certainly not ability. Women are as capable as men in succeeding in these fields. It is more of a problem of women being attracted to these fields, and feeling like they can make a difference. Supported by an NSF grant to figure out how to tackle this problem, researchers at MSU devised a three phase approach to changing women's attitudes about computer security. Phase I is a week long summer camp, exclusively for women moving into the 11th and 12th grades of high school, where they live together in the dorm, are mentored by women university students, and are given the opportunity to see computing and computer security topics from the perspective of how they can make a difference in society. The first of these summer camps was held in 2011, and was a huge success. 20 young women from all over Mississippi came to MSU for a week and left with a completely different understanding of computing and computer security. Phase II is an eight to ten week research experience for women between their freshman and sophomore years of college. At this point, they are not really ready for cooperative education or internships, but are ready to have a real research experience that can light a fire in them for learning more about the field. The first of these experiences was also held in 2011, with six young women participating. These women worked together for the summer, mentored the young women in the summer camp, and came away with an appreciation for both research and the computer security field. Phase III comes at the end of the sophomore year, and is getting them involved in an internship in the computer security field. This phase will occur for the first time in 2012, and the women that participated in Phase II are working hard to find internships for the upcoming summer.

633 - Capstone Design Course – Divide and Conquer

R. Mark Bricka

EXTENDED ABSTRACT

The capstone design taught as part of the chemical engineering curricula at Mississippi State University (MSU) has experienced steady enrollment increases from a low of 14 students in 2003 to its current class size of over 50 students. The capstone design consists of a series of two courses involving a Fall – Process Design course addressing cost estimating and process design specifics, and a Spring - Plant Design course addressing the design and costing of a grass roots chemical plant.

As the course has evolved and enrollment has grown, this generated the need to divide the Plant Design course into sections allowing course flexibility. Over the past three years, students were presented with the option to participate in the American Institute of Chemical Engineers (AIChE) national student design competition, to compete in the WERC National Design Competition, or to complete a traditional design project. This paper details the specifics of each design alternative, and presents the approaches used in the Process and the Plant Design courses to address larger class size. The general assessment of the three alternative approaches was that each was successful and improved the effectiveness of the course.

Keywords: Capstone Design, Chemical Engineering, Process Design, Plant Design, Education.

*621 - A Progressive-Based Learning Sequence in Transport Phenomena

J. R. Sanders, B. Lapizco-Encinas, J. Biernacki and P. E. Arce

Chemical Engineering, Tennessee Technological University, Cookeville, Tennessee

EXTENDED ABSTRACT

"Transport Phenomena" processes (flow of mass, momentum, and energy) are, without doubt, the core in the Chemical Engineering Curriculum and most would agree represent conceptual and mathematical challenges for students. When one examines the current approaches used to introduce Transport Phenomena to students, a very "disconnected" and "non-cohesive" learning sequence is observed in most cases. Based on an inductive pedagogy, one might think that educators would start with a tangible and familiar example with limited mathematical details so that students can concentrate on the "physics of the situation" and build their knowledge base. Once they have achieved a mastery of the basic physical aspects, students could proceed with the next level of complexity, paralleling Bloom's Taxonomy. Yet, the first course in transport phenomena (after the usual introduction to "mass and energy balances") is momentum transfer also referred to as fluid mechanics. Moreover, this subject is introduced by focusing on viscous flow concepts, a challenging topic even for experts in field! Many programs, in order to save time, offer a second course wherein both heat and mass transfer are described. Rather than follow this classical pathway we will introduce a new learning sequence based on a "progressive approach." This new methodology introduces conduction and radiation first in the course of Transfer Science I; here students do not need to worry about motion. In Transfer Science II the concept of motion (momentum) are included and finally Transfer Science III completes the picture with coupled "convective and diffusive transport." This sequence is effectively preceded by "Transfer Science 0" wherein calculus-based macroscopic conservation principles replace the traditional algebra-based balance approach. Details about the advantages and effectiveness of the sequence will be described. Feedback from the students will also be discussed.

531 - Process Intensification Modules in a Chemical Engineering Mass Transfer Course

Priscilla Hill

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

EXTENDED ABSTRACT

Traditionally in chemical engineering, courses have been taught by compartmentalizing unit operations into separate courses, with little integration of concepts between courses. That is, the details of heat exchangers, distillation columns, and chemical reactors are usually taught in three separate courses. In designing manufacturing plants, it is common to have a reaction section and a separation section of the process flow diagram. In these sections, the processing operations needed are identified and a unit operation is assigned to each processing operation. However, due to global economic competition, it is essential for companies to find more efficient methods for designing chemical production processes.

One approach that industry is using is process intensification, where different unit operations may be combined. This often yields capital cost savings because fewer equipment units are needed, and also yields significant energy savings and savings in other operating costs. Process intensification frequently merges two traditional unit operations into a single unit operation, which often requires integrating concepts from multiple traditional chemical engineering courses. To help students integrate concepts from multiple courses and to prepare them for industrial careers, modules in process intensification are being incorporated into core courses.

This has been addressed in an undergraduate chemical engineering course on mass transfer. Two modules will be presented. One module on reactive distillation combines a reactor with a distillation column and therefore integrates reaction kinetics concepts with mass transfer concepts. The second module on dividing wall columns integrates two distillation columns and concepts of mass and heat transfer. Both of these modules will be presented.

*623 - Role of Collaboration in Enhancing Creativity and Innovation in Engineering Education: Examples from Fluid Mechanics and Biotransport Courses

Chinyere P. Mbachu, J. Robby Sanders and Pedro E. Arce

Tennessee Technological University

EXTENDED ABSTRACT

Global problems in engineering education include the method of teaching and the learning strategies that are developed and applied in engineering curricula. Efforts have been made on innovation and creativity in Science and Engineering Education for effective practical and successful experiences and outcomes. There are several methods assessing creativity and innovation in engineering students that integrate different techniques in the curriculum with the provision of a safe environment for experimentation, learning, and student enrichment in these critical topics; however, several aspects need additional attention including for example, implementation protocols, strategies for designing efficient environments, etc. Furthermore, the impacts of creativity and innovation in Engineering Education are important in identifying and assessing modifications to the engineering classroom experience. One very important and somewhat forgotten aspect is the role of collaboration in promoting creativity and innovation in Engineering Education.

Creativity is the science of human innovation; it involves collaboration, failure, building on past efforts, and an effective communication of ideas (Sawyer, 2008). The ability to solve problems and to think critically and creatively is important. Students in engineering programs are, for example, repeatedly instructed to list any assumptions being made when solving engineering problems. They are also strongly encouraged to think about scenarios where those assumptions may not apply. In its vision for the engineer of the year 2020, the National Academy of Engineering (NAE) espouses ten attributes that such an engineer should possess that include strong analytical skills; creativity (invention, innovation); good communication skills committed to the concept and practice of lifelong learning.

The approach used in this study is based on the student's collaboration to effectively transfer knowledge and promote the identification to new alternatives to "given solutions". The preliminary studies will be presented based on the examples gathered in two courses in Chemical Engineering, i.e. a junior level Fluid Dynamics course and a senior level biotransport course. The finding will be related to the Linear Engineering Sequence (L.E.S.) of the High Performance Learning Environment (Hi- PeLE) that is being used in several courses in Chemical Engineering at Tennessee Technological University, Cookeville, TN USA.

543 - A Viable Alternative: Fiber-Reinforced Polymer

Harry S. Ramnath and Fazil T. Najafi

University of Florida / University of Florida

EXTENDED ABSTRACT

This paper presents an illustration of the potential cost savings of fiber-reinforced polymer composites over steel-reinforcement based on a life cycle cost analysis. In 2008, the American Association of State Highway and Transportation Officials officially acknowledged the use of fiber-reinforced polymer composites through a publication of standards for its use on bridge decks. If used, fiber-reinforced polymer composites serve to eliminate the potential for corrosion, decrease repair time and increase the life of structures significantly, which correlates to savings across the board. As such, the objective of this paper is to prove that fiber-reinforced polymer composites are economically feasible regardless of their high initial cost.

Through a Life Cycle Cost analysis, this paper proves that when comparing a bridge deck with fiber-reinforced polymer composites to a bridge deck with steel-reinforced concrete, the former becomes the cheaper alternative in 20 years.

545 - Paper withdrawn

569 - Developing Modeling Software for Engineering Majors with Emphasis on Water Resources

Samuel Camacaro, David Rivas, and Jairo Diaz-Ramirez

Mississippi State University / Universidad Nacional de Colombia / Mississippi State University

EXTENDED ABSTRACT

Currently, modeling tools with graphical user interfaces are beneficial for teaching engineering. In teaching water-related courses, the complexity of rainfall-runoff theory can be softened by using computer models. In rainfall-runoff analyses, calculating soil infiltration rates is key to computing how much water enters the soil column and how much water flows over the ground surface as runoff in a finite lapse of time. The goal of this project was to develop a stand-alone graphical user interface tool where users can select different soil infiltration equations using the MATLAB programming language. The infiltration analysis tool is called WATIC and consists of over 20 formulas divided into three groups: empirical, conceptual, and other models. The WATIC software will support engineering problem-based learning activities in water-related majors.

620 - Bridge And Operational Maintenance Training For Professionals And Asset Managers At The College Level

Adnan Javed and Fazil T. Najafi

EXTENDED ABSTRACT

United States transportation network is the most extensive in the world. Bridges are a critical element of that network, and they are essential to the country's economic development, emergency response and national defense. As this millennium dawns, the United States is in the midst of a "bridge crisis", i.e. maintenance needs for older bridges have far outpaced available resources. This situation indicates the need not only for improved repair and rehabilitation techniques but also for a comprehensive approach to bridge management. In order to implement effective bridge maintenance and management programs and strategies, trained asset managers and bridge professionals are needed now than ever. The new field of expertise related to aging infrastructure is on the rise, as the nation realizes that existing assets are failing, and maintenance has recently suffered in large part due to limited federal and state funding. But having professionals who understand these systems in depth and can prioritize needs based on limited funding opportunities can make all the difference. Today many of the bridges in the United States are in various stages of disrepair with a disturbing number being classified as structural deficient requiring the bridge to be closed or limited to specific times of operation or load capacities across the bridge. This paper attempts to discuss some of the state-of-the art maintenance techniques and suggested training needs, to allow for safe use, increased performance capabilities and an improved condition of aging bridges in the United States.

503 - Promoting Self-Efficacy and Life-Long Learning in Conjunction with an Awareness of Contemporary Issues in Geotechnical Engineering

Tanya Kunberger

Florida Gulf Coast University

EXTENDED ABSTRACT

Geotechnical Engineering II is a senior level design course that is the second in a two-course sequence, and is a required component of the Civil Engineering curriculum at Florida Gulf Coast University. The course focus is on the design and synthesis of information, and the primary topics covered are lateral earth pressure and retaining wall design, slope stability, and shallow foundation design including bearing capacity and settlement. Assessment mechanisms involve group projects, individual in class designs (exams), "roundtable" activities and a semester specialization (essentially an individual project). Semester Specialization final deliverables: a review article of approximately 5000 words in a standardized template, a single page handout, and a 3 – 5 minute oral presentation; are built throughout the semester from a series of smaller assignments. These smaller assignments are designed not only to ensure that students are progressing at a reasonable rate, but also to incorporate both the editing process as well as a reflective piece into the assignment.

This paper focuses on the details and development of the semester specialization over four semesters of offering the course. Assessment of student performance of course objectives and program outcomes will be presented with emphasis on an ability to communicate effectively, recognition of the need for, and an ability to engage in life-long learning, and knowledge of contemporary issues, relating to ABET outcomes g, i, and j respectively. Student self-assessment of performance on related course objectives and program outcomes as well as feedback and evaluation of the activities will also be included.

517 - Ink Dot Technique of Flow Visualization for the Undergraduate Fluid Mechanics Laboratory

William S. Janna

EXTENDED ABSTRACT

The ink dot technique consists of applying ink dots on a surface of an object that is placed in a low speed wind tunnel. The dotted area is then sprayed with oil of wintergreen (synthetic methyl salicylate) to coat with a thin but continuous film. The ink dots dissolve and diffuse into the oil. As air moves past the object, the dissolved ink dots trace out a streakline. The objective of this study was to find an alternative method of applying ink dots, and obtaining streamlines of flow about a body. The improved method consists again of applying a matrix of ink dots to paper. The dots are applied to printer photo paper and sprayed with alcohol.

Conclusions

The search for a simple and inexpensive method of obtaining streamlines yielded positive results. The ink dot method was modified appropriately for this study. Rather than oil of wintergreen, rubbing alcohol (diluted with water) is used. Inexpensive markers (available at a bookstore) and photo paper both are also used. The results shown here were obtained by students without the need for immediate supervision. It is concluded that the ink dot method of obtaining streamlines of flow is an effective technique that students can use to obtain rather interesting results. It is a welcome addition to the fluid mechanics laboratory.

518 - A Centrifugal Pump Project: An Extracurricular Student Project

Taylor Weatherford, Robert Choate, Joel Lenoir, Kevin Schmaltz

Western Kentucky University, Mechanical Engineering Program

EXTENDED ABSTRACT

A student worker, the first author of this paper, at Western Kentucky University was recently given the opportunity to re-design a centrifugal pump test bed to make it into a valuable piece of lab equipment. The test bed was initially conceived for instructional purposes in a senior level Mechanical Engineering laboratory course; however, time and financial constraints prevented its completion and commissioning. The student worker began a project to complete the test bed as well as improve some design elements which had been shown to be less than desirable.

With the test bed, students can observe and take data for relevant pump parameters including volume flow rate, pressure head, and brake horsepower input in order to plot the pump performance curves. The test bed incorporates two pumps so that one pump can be run alone, or both in either series or parallel configuration to observe the different operating points for the varying configurations.

Changes were made in an attempt to simplify and improve certain aspects of the initial design, some of which introduced new challenges and required the student to look back to elementary energy equations to understand pump performance. Additionally, unfinished portions of the original project were completed to provide a complete and ready-to-use test bed.

This paper presents the design decisions and challenges which were encountered by the student and faculty involved. In addition, the costs and benefits of allowing a student to collaborate with faculty to design, build, and test a system rather than purchasing a solution are addressed.

526 - Redesign of an Airflow Test Bench: An Independent Student Project

Hussain Altammar, Robert Choate, Joel Lenoir, Kevin Schmaltz

Western Kentucky University, Mechanical Engineering Program

EXTENDED ABSTRACT

The redesign of the existing airflow test bench was required to minimize overall leakage rate and improve the aerodynamic performance of the system. The redesigned airflow test bench will be designed, built, and tested (DBT) for use as an instructional tool in an undergraduate mechanical engineering thermal fluids laboratory and for possible industrial outreach opportunities. An airflow test bench is a system used to measure the aerodynamic performance of complicated passive devices, such as HVAC duct networks or filters and of active or air moving devices (AMD's), such as fans and blowers.

The existing air flow test bench was constructed of melamine coated panels joined to form a square plenum. Three windows were also designed into the walls of the plenum. It has been observed that significant air flow leakage occurs where plenum sections join and around the windows. Multiple attempts have been made to mitigate this leakage through the sealing of these joins with limited success. Therefore, an alternate method proposed to minimize leakage is the reduction of the number of apertures through the redesign of the existing air flow bench. The use of a circular instead of square duct was the first major design consideration, since air leakage at the corners and around the windows would be a non-issue. In addition, circular cross-section plenum improves the aerodynamic performance of the bench by elimination of secondary flows created at the corners of the square plenums and an attempt to minimize entrance region effects.

The test bench will be primarily beneficial for future junior and senior mechanical engineering students studying fluid mechanics phenomena in viscous internal flow regimes. They will have the ability to demonstrate the aerodynamic characteristics of various geometries and AMD's or turbomachines, and compare them with their theoretical predictions. Students can use the bench to gather pressure drop and volumetric flow rate data then prepare plots of system performance for the device under test (DUT). An important aspect of this project is that the Mechanical Engineering Program is able to enhance one of its laboratory test beds while giving an undergraduate student valuable learning experiences by executing the project.

539 - Teaching Virtual Instrumentation to Biomedical Engineering Students

Jonathon Toft-Nielsen, Jorge Bohórquez and Qian Shen

University of Miami/ University of Miami/ Mount Sinai Medical Center

EXTENDED ABSTRACT

The Department of Biomedical Engineering (BME) began offering a course entitled "LabView Applications in Biomedical Engineering" in the fall of 2004. The goal of this one credit course was to better prepare students for their engineering practice by developing skills in virtual instrumentation and the creation of biomedical device prototypes that involve real time physiological signal acquisition and processing. A hands-on methodology that fosters creativity and self driven learning was developed for this course. At the outset of each two and a half hour weekly lecture, the instructor, utilizing a combination of blackboard and projector, provides a brief introduction to the programming concepts the lecture will cover. This is followed by a guided example program, illustrating the concepts, which is developed step-by-step as the students follow along. Following the guided example, students are assigned a related, albeit more sophisticated program to develop individually within the class period. Additionally homework, consisting of an "open" problem, is assigned weekly. The homework is designed to encourage active learning and to reinforce concepts. The complexity of the weekly problems steadily increases along the semester and the students are encouraged to reuse and build on their previous code to solve the new, more challenging problems. During the last weeks of the semester the students are assigned a final project developing a biomedical monitoring device (ECG, EEG or EMG) including all the functionalities of like devices, such as: real-time data acquisition, digital signal processing, highly elaborated user interface and ability to save a recall signals to and from permanent storage. To facilitate such a course, the BME department bought and installed eight Data Acquisition systems, and purchased a departmental academic license for LabView. The students are afforded 24/7 access to the software via the College of Engineering computing Cloud. The syllabus, schedule, laboratory session descriptions, hardware adaptation descriptions along with the assessment of the main objectives will be presented in this paper.

628 - Development of a Modern Integrated Thermal Systems Design Laboratory – A Follow-Up

John Abbitt

Department of Mechanical & Aerospace Engineering

University of Florida, Gainesville, FL

2012 ASEE Southeastern Section Annual Conference, April 1-3, 2012

Mississippi State University

EXTENDED ABSTRACT

In 2006, The Department of Mechanical and Aerospace Engineering at the University of Florida began the process of developing a modern thermal systems laboratory that integrates a broad range of topics from the engineering curriculum with the objective of improving the analytical ability, teamwork skills, and, most importantly, the design expertise of our students. This is accomplished by coordinating just-in-time lectures with hands-on, small-group laboratory experiences involving industrial-type equipment and data acquisition systems, a design objective for each experiment, and culminating in an open-ended group design project. The integrated lectures, laboratory experiments, and design experiences in such topics such as heat exchangers, pump/pipe system matching, pool boiling, cooling towers, and air-conditioning break down the traditional compartmentalization of these education experiences. During this development, we have received numerous requests for descriptions of the equipment and experiments used in our labs. We reported on our progress at the 2009 ASEE meeting. Since 2009, we have accomplished even more than we had in the first three years, and feel that it is appropriate to report on our recent development. This paper addresses the apparatus in the laboratory, as well as the experiments. We also discuss the novel method used to fund the laboratory.

Technical Session 2 Monday, April 2, 2012 1:40pm – 3:20pm

01:40 pm – 3:20 pm	T2-A Colvard Union 328	T2-B Colvard Union 329	T2-C Colvard Union 325	T2-D Colvard Union 330	T2-E Colvard Union 231
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Moderator	*Joseph Coe*	*Paul Palazolo*	*Daniel Kohn*	*Ahmed Abukmail*	*Lulu Sun*

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538 - Engineering Education's Role in Improving Student Understanding and Learning of Mathematics and Sciences 2-38
Cecelia M. Wigal, Vincent C. Betro

* This abstract is a presentation only abstract without a full manuscript in the conference proceedings

552 - A First-Order Approximations Module for a First-Year Engineering Course

Randal S. Schwindt

Union University, Jackson, TN

EXTENDED ABSTRACT

First-order approximations are important mathematical tools which find application across science and the engineering disciplines. They are the heart of the common technique of linearizing nonlinear systems around an operating point. Applications range from the simple pendulum to analog electronic circuits to control systems. In addition, as is well-known, the mathematics skills of aspiring engineers are critical to future success, and, as a result, many first-year engineering programs place considerable emphasis on developing students' mathematics skills, supplementing or even replacing traditional mathematics instruction. This paper describes a first-semester engineering course module on first-order approximations. The engineering course assumes only a high school precalculus background and does not employ calculus. The course supplements but does not replace traditional mathematics instruction and is typically taken concurrently with the first calculus course. While first-order approximations are related to Taylor series expansions, a topic typically covered in a second or third term calculus course, first-order approximations are themselves simple, algebraic formulas. This module explores the first-order approximations of a number of functions which occur frequently in engineering, such as $(1+x)^n$, e^x, $\sin x$, and $\tan x$. They are explored computationally rather than theoretically. They are applied to specific problems to compute approximate solutions. Applications include estimating fuel mileage, square roots, and exponential growth and decay. This exercises students' precalculus math skills, builds their skills at applying mathematics, strengthens their understanding of nonlinear functions, provides tools for making "back of the envelope calculations," and prepares them to see these concepts in greater depth later. This module was first implemented in the 2010 fall term, so the paper's results are still preliminary. The desired outcomes are: 1) enhanced retention and 2) improved performance in subsequent technical courses, most immediately in foundational mathematics and physics courses. For formal assessment of the module's effectiveness, retention in the engineering major and course grades in Calculus I and Physics I are used. Data from two years prior to implementation and the 1.5 years since implementation are compared. To date, Calculus I and Physics I course grades show no improvement, while first-to-second year retention in engineering for the year after implement was 86%, 21 percentage points higher than before. The long-term improvement in retention seems likely to be lower, though. The module will continue to be a part of the first-semester freshman engineering course for at least one more academic year in order to assess more extensively the module's effectiveness.

572 - An Electrical Circuits Hybrid Course Model

Ken Swayne

Pellissippi State Community College

EXTENDED ABSTRACT

As electronic and computer technology become important tools in the modern classroom, most engineering technology educators struggle with the best approach to incorporating these tools within a course that has a laboratory component. Some instructors resist the use of web technology completely, while others find ways to use the technology as a course enhancement tool by making lecture material available online or simply communicating assignments to the students; however, one of the most challenging considerations to the instructor is whether a technology course with a lab component, such as electrical circuits, can fit an online course model.

Purpose

Fitting a traditional engineering technology course with a lab component into an online course model appears to create challenges in the development of hands-on skills. The research question seeks to establish that a hybrid course model, which integrates an online lecture and on-campus laboratory experience, is a suitable course format.

Design/Method

A basic DC/AC circuits course is structured for an online environment. Methods for incorporating a laboratory component into this environment are explored, and the challenges are evaluated. A more practical hybrid course model is presented. A survey tool is applied to evaluate student perceptions about the components of the hybrid course. In addition, a variety of assessment tools are applied to measure the course effectiveness.

Results

The course model holds a mixture of success and failure. The students offered limited criticism of the course structure; however, student feedback on course improvement has the potential to create a successful course design. Assessment tools reveal a slight decline in student performance in the hybrid course compared to the traditional course offering. Further, the data indicates that non-traditional students were more successful than traditional students in the hybrid course.

Conclusions

An electrical circuits course with a lab component is difficult to fit into an online course model due to the laboratory component. The hybrid course model provides a better fit, but with some noticeable deficiencies.

537 - MatLab Marina: Web-Based Tutorials for Teaching Programming Concepts using MATLAB

Priya T. Goeser, Anthony Flett, Justin Kriske and Charles Panter

Armstrong Atlantic State University

EXTENDED ABSTRACT

Current research on the effectiveness of virtual learning environments shows positive results including the reinforcement of concepts from lectures, exposure to practical applications and problems and the ability to meet diverse pedagogical needs. These are used as supplements in certain courses to improve students' understanding of fundamental concepts, student interest and student performance. The objective of this project was to develop such an environment – 'MatLab Marina' to supplement programming courses such as: Computing for Engineers (ENGR1371) taught at Armstrong Atlantic State University**.**

ENGR1371 is a 3-credit freshmen engineering course with the primary objective to study the fundamentals of programming and to solve engineering problems using MATLAB. Specific topics include: general principles of abstraction, testing, debugging and problem solving and programming concepts such as arrays, execution control, functions, structures, recursion, plotting, file I/O, images, sound and numerical methods. These extensive topics warrant a 2-semester course when covered in depth and detail. However, in a 1-semester session, instructors are forced to emphasize either teaching the use of the tool (MATLAB) or teaching programming concepts. While both are necessary, a good understanding of programming concepts can be applied to any programming language. In addition, students view this course to be a collection of abstract concepts, rules and methods that are difficult to understand and apply to engineering problems. It is proposed that a supplement such as MatLab Marina can address this challenge.

MatLab Marina is a framework of web-based learning modules and tutorials dedicated to the improvement of student learning of programming concepts. Currently there are two phases: Beginning and Intermediate Programming with a total of about thirty three tutorials. These tutorials provide a balanced understanding of both algorithm development and programming using MATLAB. Further details including assessment results based on student surveys and other statistics are discussed in the paper.

501 - A Different Approach to Multi-Discipline Senior Design

Hodge Jenkins, Scott Schultz, and Ha Vo

Mercer University
School of Engineering

EXTENDED ABSTRACT

Many faculty believe that Senior Design teams consisting of multiple engineering disciplines enhances the learning experience, produces superior designs, and represents a more real world experience. In our experience this is true in many cases. However, at times a given mix of engineering skills does not produce a quality learning experience for all students.

In this paper, we explore this issue from an experiential standpoint. In particular we focus on the interaction of industrial engineers on various senior design teams. We show both successful integration and not-so-successful integration of an industrial engineering student on a design team. We then present and demonstrate an alternative approach on how industrial engineering adds value to a senior design project. Two cases are presented in which teams of biomedical engineers design prosthetic devices in the first year, followed by teams of industrial engineers who design high volume production processes for the devices, including product design modifications. We believe through anecdotal evidence that the students using this approach obtained a superior senior design experience.

610 - A Perspective of the Forces Driving Change in Engineering Education

Dennis J. Fallon and Kenneth P. Brannan

The Citadel

EXTENDED ABSTRACT

A number of forces have been steadily gaining momentum over the last few decades and have the potential to significantly impact the engineering education landscape well into the future. Recognition of these forces and their characteristics is an essential foundational step in developing well-conceived strategies to face challenges posed by the individual and collective effects of these forces. Technology is an example of a force that has demanded continuous and creative implementation at a high cost to meet the needs of today's students. Engineering education can be significantly impacted by multiple decisions that are made concerning technology. These decisions include which technologies are incorporated into the engineering classroom, how engineering educators respond to pressures from industry, how issues related to distance learning are addressed, how information will be delivered to students, and how social networking (such as Facebook and Twitter) is used in teaching students. Other forces include knowledge of how people learn, accreditation, the economy, student populations, and global challenges. The paper discusses these forces and the impacts that they have had on the direction of engineering education.

550 - So How Did That Go For You? Early Career Engineers' Success in Meeting Goals set as Undergraduate Seniors

Katherine Winters, Holly Matusovich, and Cheryl Carrico

Department of Engineering Education, Virginia Tech

EXTENDED ABSTRACT

Graduating seniors are often asked about their future career plans, but it is less common to follow up and see how successful they were in achieving their goals. The purpose of this study is to explore how early career professionals perceive their success in achieving the goals they set as advanced undergraduates and what factors have contributed to this success. We frame our study in Social Cognitive Career Theory (SCCT), as this framework specifically addresses factors contributing to relationships between career goals and actions. The 20 participants in this study are a sub-set of those initially recruited from two different institutions as traditional-aged college freshmen in 2003 as part of the Academic Pathways Study (APS). Most completed their bachelor's degrees in engineering in 2007, although some graduated in 2008. The Engineering Pathways Study (EPS) follows up in 2011 with interviews and surveys to understand transitions to the workforce. This analysis utilizes data from participants' junior and senior years of undergraduate work as well as post-graduation data. Following case study methods, interviews were recorded, transcribed verbatim, and coded along with free-response questions from surveys. Results indicate that many participants have been successful in following the path they intended as graduating seniors. However, several participants have been unable to find work in their desired field, experienced job losses, or discovered that they do not enjoy working in a particular environment or field. Other participants have modified their career goals because of family concerns, such as prioritizing a spouse's education or caring for an elderly grandparent. Findings from this study will enable faculty and administrators to better understand factors that influence their graduates as they enter the workforce, and therefore better prepare graduating engineers to meet their goals.

553 - Improving FE Pass Rates through Changes in Attitude

Charles Newhouse and David Johnstone

Virginia Military Institute / Virginia Military Institute

EXTENDED ABSTRACT

All engineering students who attend the Virginia Military Institute (VMI) are required to take, but not necessarily pass, the Fundamentals of Engineering (FE) exam prior to graduation. It has been considered acceptable for pass rates to fall slightly below the national average due to the mandatory FE requirement and time constraints which include a rigorous core curriculum, seven physical education classes, eight ROTC classes, mandatory military training, and a "Spartan" lifestyle in barracks. The VMI Civil and Environmental Engineering (CEE) department has recently decided to implement new strategies in an attempt improve the FE pass rate. The initial thought was that finding time for the students to study would be the biggest obstacle to overcome; however, it was found that the most significant factor contributing to improving the pass rate was attitude. This paper presents some of the strategies used in the past to prepare students for the FE exam and how changing students' attitude improves performance on the exam.

Postscript

Results from the October 2011 exam were released after the original paper was submitted. Eleven of the thirteen cadets who took the exam passed, producing a pass rate of 85%. This was one of the highest pass rates ever achieved at VMI. This helps to support the assertions made in the paper.

541 - Preliminary Assessment of Summer Enrichment Program

Robert W. Whalin and Qing Pang

Jackson State University

EXTENDED ABSTRACT

The School of Engineering at Jackson State University initiated, in 2009, a ten week Summer Engineering Enrichment Program (SEEP) for first time freshmen School of Engineering majors to enhance retention rates and increase graduation rates. The program was repeated in 2010 and 2011 and is scheduled to continue through the summer of 2015. Admission to SEEP was open to students with ACT Math scores in the 17 to 25 range. The SEEP program enrolled first time freshmen in College Algebra the first summer term and Trigonometry the second summer term. Students were then enrolled in Calculus I during the fall semester, thereby decreasing the time to graduate while enhancing first and second year retention rates. In addition to preparing first time freshmen engineering majors with sufficient mathematics knowledge to succeed in Calculus I and successive mathematics courses, the program is designed to provide an acclimation to college life, provide an introduction to engineering careers and promote self-confidence. Design of the SEEP program and all its components are described in the paper including math lectures, tutoring, introduction to engineering, study periods, student mentors from previous summers, trips to engineering employers, etc. A comprehensive analysis of the performance and retention of SEEP participants was conducted based on two years of program data, including participants' enrollment and performance in Calculus I, Calculus II, Calculus III and other fundamental courses, as well as their 1 year and 2 year retention rates in the School of Engineering. The performance, retention and graduation data are compared with historical data for first time freshmen in the School of Engineering at Jackson State University. Results to date are very encouraging.

*568 - Preparing the STEM Workforce for the Future: Proactive Efforts at Mississippi State University to Address Shifting Population Demographics

Breanda Kirkland, Jairo Diaz-Ramirez, Giselle Thibaudeau, Kathleen Sherman-Morris, and Karen McNeal

Mississippi State University

EXTENDED ABSTRACT

Shifts in population demographics across the United States, and on college campuses, are not paralleled in STEM classrooms or in the STEM workforce. In the US, the ethnic and racial composition of the population under 20 years old has shifted and will continue to shift significantly. By 2050 Anglo-American will be an ethnic minority group. As population increases in the future, demand for basic resources, such as water and energy will increase. Meeting those demands will require a larger, better educated STEM workforce. In science and technology classrooms, however, all genders and ethnic groups are not equally represented. In introductory geology courses at Mississippi State University, women and members of minority groups are represented in proportions similar to the whole campus population. In senior and graduate courses women and minority groups are significantly under-represented. In data collected from one senior/graduate level course, Structural Geology, over the course of four years, only 27% of the students were women and only 8% were Hispanic or African-American. In order to meet coming demands for scientists and engineers to fill the work force of the future, universities must begin now to enroll more members of under-represented groups into the STEM programs.

At MSU, efforts in the Department of Geosciences to educate a fully representative student population include: encouraging undergraduates to participate in research projects and attend professional meetings; creation of an intensive, interdisciplinary research experience; and creation of a seminar series to introduce undergraduate students to career possibilities in the geosciences. In parallel inclusive diversity efforts, the water resources engineering group at MSU is encouraging Hispanic university and campus undergraduate students to work on sustainable water management research projects as well as promoting graduate study with recruitment conferences, summer courses, internships, and assistance with graduate school application fees.

538 - Engineering Education's Role in Improving Student Understanding and Learning of Mathematics and Sciences

Cecelia M. Wigal, Ph.D. P.E. and Vincent C. Betro, Ph.D.

The University of Tennessee at Chattanooga

EXTENDED ABSTRACT

Understanding science, technology, engineering and mathematics (STEM) topics and applications is a priority of the United States (U.S.). The State of Tennessee and its Department of Education (T.D.O.E.) are specifically interested in the effects of STEM initiatives on the employment prospects of citizens and the general economic growth of Tennessee. The state's goal is to expose students to engineering applications early with hopes of increasing the number of students interested in pursuing careers in STEM fields. However, teachers are often underprepared to discuss such careers and to teach such curricula. This paper presents two initiatives at the University of Tennessee at Chattanooga (UTC) that prepare teachers to address STEM needs. One, UTeaChattanooga, prepares students pursuing four-year degrees in STEM fields to obtain licensure at the secondary education level to teach math and science. The other, Technology/Engineering + Literacy = Mathematics Understanding (TELMU), introduces in-service teachers to activity-based learning exercises that increase mathematical and science aptitude through engineering applications

UTeaChattanooga

UTeaChattanooga is one of 22 nationwide replication sites of the first UTeach program created at the University of Texas, Austin. UTeaChattanooga is a cooperative program between three colleges (Arts and Sciences, Engineering and Computer Science, and Health, Education, and Professional Services) and 7 departments (Applied Math, Biology, Chemistry, Geology, Physics, Computer Science, and Engineering). UTeaChattanooga is the only UTeach program in the nation that includes an Engineering degree. In this concentration students obtain a BSE degree from an ABET-accredited program and obtain the education necessary to sit for state teaching licensure exams in secondary Math and Physics.

TELMU Academy

The focus of the TELMU Academy is to provide participants, present certified math and science teachers, with hands-on experiences that strengthen their pedagogical content knowledge in grades 6-9 mathematics through the use of inquiry-based and activity-based science. This is addressed by using (1) curricular materials involving engineering and technology to support Tennessee's process and content standards in mathematics, (2) research-based reading strategies to strengthen student comprehension of STEM content disciplines, and (3) literacy lessons to strengthen comprehension. This project uses nationally developed activities found successful at the middle school and 9th grade levels. The activities are specifically successful at introducing students to engineering principles that enhance scientific and mathematical literacy.

616 - Teaching of Math and Physics Using a Flight Simulator

M. Javed Khan, Chadia Affane Aji, Marcia Rossi

Tuskegee University/ Tuskegee University/Alabama State University

EXTENDED ABSTRACT

The challenges associated with the learning of Math and Science by K-12 students are well documented in literature. A multi-modal learning environment that includes active learning can be an effective approach to addressing challenges such as interest and proficiency. This paper presents an active-learning approach to the teaching and learning of Mathematics and Science concepts for 9-12 grades using commercial off-the-shelf (COTS) flight simulation software and hardware. Several modules have been developed which include detailed lesson plans and student activities supported by specially designed scenario-based flights. Students use the flight parameter data to determine answers to scenario-based questions, thus providing a link between Math and Science concepts taught in the class and a 'real-life' situation. The lesson plans were developed with input from the local school district teachers where the approach is planned for implementation during the 2012-2013 academic year. Eight undergraduate students from Aerospace Engineering, Mathematics, and Psychology at Tuskegee University assisted in preparing these modules. The preparation of these modules provided experience to the undergraduate students in working in interdisciplinary teams. These students also assisted the project team during the workshops and mentored the high school students. Teachers' responses to the approach have been positive as assessed through surveys during summer workshops in which the approach was introduced. A statistically significant positive attitude to the approach was registered in the pre-post surveys administered to the high school students who participated in a summer experience. The work is funded by the NSF ITEST grant.

*561 - Online Teaching Module in Electrical Engineering for K-12 classes

Danielle Thomas and Thomas Yang

Glades Middle School, Miramar, FL / Embry-Riddle University, Daytona Beach, FL

EXTENDED ABSTRACT

This paper describes our recent effort to expose students to STEM disciplines while in grades K-12. The effort was part of the NSF-sponsored Research Experience for Teachers (RET) program at Embry Riddle Aeronautical University (ERAU) during a six-week period in summer 2011. Our goal is to inspire students' interests in engineering, and encourage them to take higher-level courses in Math and Science in middle and high schools, so they can be more successful once they enroll in an Engineering program in college.

We developed a module for electrical circuit design that utilizes an online format. This module can be used in grades 6 -12 to expose students to electrical engineering. The module begins with an interactive powerpoint presentation that examines how technology has developed and changed over time. It demonstrates how computers and computer parts have been compressed in volume and integrated over the past 50 years. Students will then use examples of circuit board and integrated circuit to create a Venn diagram.

The 2nd activity is another powerpoint about the signal format used in telecommunication. Students are introduced to the binary number system and its significance in digital communication. Students then complete an online binary code activity. Utilizing an online tool, students translate words and phrases into binary codes and vice versa.

The 3rd activity is to create a compare and contrast essay that examines how signal transmission has evolved and developed over time. Students combine their personal research with the concepts taught in class. They are required to explain the signal transmission process and the binary code. Students will also describe their own ideas about how wireless communication will develop in the years to come.

The culminating activity is the online exploration and circuit-building lab. As preparation, students learn the essential electricity vocabulary through illustrations that include words, definitions, sentences and pictures. Then they use three websites to build circuits, beginning with simple circuits and quickly progress to complex ones. Working alone or in groups, students will experiment with many different circuit configurations. The online format allows them to be exposed to electrical engineering activities in an inexpensive and fun way, and allows them to build circuits at home as well. We believe the online format is an economical approach, especially because many school districts in the nation are facing budget cuts. Also, teachers do not have to worry about the safety of electric circuit labs.

As initial implementation of the proposed teaching module, it is being adopted in a 7th grade Science class at Glades Middle School. Our module can also be adapted to an introduction to more complex projects in electrical engineering for Science classes in middle and high schools as well.

530 - K-12 Demos for Outreach in Chemical Engineering

Priscilla Hill

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

EXTENDED ABSTRACT

Recently, there has been a focus on encouraging pre-college students to pursue careers in science, technology, engineering, and mathematics (STEM). While new STEM high schools are being opened across the nation, not everyone has the opportunity to attend a STEM school. Therefore, it is necessary to reach out to other students through programs such as summer camps. This outreach project focused on developing simple hands-on activities for use in summer engineering camps. In this paper, experiments are activities where a variable is controlled and a result is measured, and demonstrations are activities that illustrate a concept but do not have a measured result.

The goals of this K-12 outreach are to develop simple hands-on activities that demonstrate particle technology concepts to high school students, and to encourage students to consider careers in STEM fields. These experiments and demonstrations are designed to be hands-on activities that use inexpensive, readily available materials. The purpose of using hands-on activities is to stimulate active learning. This was implemented with students at existing summer camps at Mississippi State University. However, the demonstrations and experiments are portable and can be readily adapted to high school class room settings.

This presentation will discuss the implementation, including activities and discussion with the high school students. Examples of activities will be given, such as simulating gold panning by dry panning. The materials needed, procedure, and possible variations will be presented. Examples are given of discussion topics and questions that emphasize the connection of the experiment to real world problems as well as demonstrate scientific principles. The connection between the activities and NSF broader impacts will also be discussed.

556 - Bringing Water Quality into the Eighth Grade Science Classroom

Richard Forehand, Beth A. Todd, and Pauline Johnson

University of Alabama

EXTENDED ABSTRACT

A topic in the eighth grade mathematics curriculum is multi-step equations. Students often do not see the real world applications of theoretical mathematics at this level. A clean water and aging infrastructures project is underway in three counties in rural Alabama including the setting of our GK-12 project where STEM graduate students take their work into K-12 classrooms. A scenario from this project was used as an activity in eighth grade mathematics.

Students were asked to consider a community of six houses with different sized families connected to a water tank. They discussed ways water is used and developed an estimate of average daily water consumption per person. Then students were asked to determine the tank volume to meet the needs of this community. Other issues in water tank design were introduced to the class.

A second activity was created where students were introduced to pH and plotted the results of their measurements on bar graphs. They measured pH of water from different locations and also modified the water with common household chemicals to determine the change in pH.

These modules helped students to see real world applications for mathematics. The activities reinforced the use of equations for problem solving and the use of graphing to communicate data. The students also observed how STEM topics can be used as tools that can benefit their communities and their families.

This project is funded by the NSF GK-12 program, 0742504.

511 - A Multi-Team Multi-Semester Large-Scale Capstone Project Experience

Sean Owens and Tommy Morris

Mississippi State University / Mississippi State University

EXTENDED ABSTRACT

In 2010, NASA sponsored a Senior Design project at Mississippi State University to implement the ITU G.729 voice CODEC standard on an FPGA using Verilog HDL. This project provided a unique experience for the students involved. It allowed students to interact directly with NASA engineers. It also gave students the opportunity to experience working on a large-scale multi-team project. A distinctive aspect of this project is that it has required four separate senior design teams to complete. Each team began the Senior Design course one semester after the previous team, and this staggered entrance forced inter-team cooperation and project management, and led students to move to an open-source development model. This paper will outline the key aspects of the project, explain how the multiple team structure has evolved over the four semesters while adhering to Mississippi State University (MSU) curriculum requirements, and discuss the benefits and detriments associated with multiple team projects. It may serve as a reference model for larger, multiple-team capstone projects in the future.

516 - Ethics for the Information Age

Claire L. McCullough

University of Tennessee at Chattanooga

EXTENDED ABSTRACT

Information technology has grown at an astounding rate in recent decades, and with it have grown ethical questions and difficulties which did not exist thirty years ago. Cyberbullying, identity theft, phishing, dangers involved in social networking, cyberstalking, and hacktivism are just a few of the issues now facing not only computer engineers and computer scientists, but also the general population of business and casual computer users. While in the past, society's laws have been, at least to some extent, in sync with the community's ethical mores and capable of addressing ethically significant issues such as theft, the rapid growth of computing capabilities and related issues has out-stripped the law-making process in the United States and elsewhere, leaving many with no firm guidelines for behavior and no legal recourse when victimized. This paper describes two courses developed at the University of Tennessee at Chattanooga to deal with these issues: a junior level class required of all Computer Science and Computer Engineering majors at the university, and a freshman level seminar class, designed to introduce first semester freshmen to both ethical issues and dangers inherent in the cyberworld. Each of these classes is open to students of any major; however, they can easily be used to assess ABET outcome "(f) an understanding of professional and ethical responsibility"[1] for all engineering majors, as well as some of the “soft skills” that are sometimes problematic for evaluation. This paper discusses the mechanics of the classes, current topic coverage, variations that be used to adapt the courses to specific engineering disciplines, and ways that such a course, or selected elements thereof, could be included in engineering programs already limited in hours.

[1] *Criteria For Accrediting Engineering Programs*, ABET, Inc., Baltimore, MD, November 12, 2010.

557 - A Cry for Help: Persuading Cell Phone Developers to Get Involved with Digital Forensics

Kendra Carr

Mississippi State University

EXTENDED ABSTRACT

Digital forensics predominantly concentrates on the accessibility of retrievable information from a particular device. This paper focuses on the recovery of information from cell phones and the admissibility of the recovered data in court. The rapid advancement of cell phones has enlarged the range of activities a user can implement and the quantity of information held within the cell phone. Digital Forensic tools are used to help forensic investigators recover information and determine whether or not a crime has been committed and to present the potential evidence in court. The growing awareness of the critical information discovered within cell phones has pressed for digital forensic tools to rapidly evolve. However, without the help of cell phone designers, forensic tool developers will continue to struggle to keep up with the constant growth of new cell phone releases. This paper states the importance of digital forensic tools for cell phones, describes available methods for retrieving information from cell phones, and discusses the legal requirements for presenting evidence in court. The goal of this paper is to identify the weaknesses in cell phone digital forensics and to inform cell phone designers that the advancement of cell phone forensic tools will not occur rapidly without their help, involvement, and cooperation.

605 - Podcasting to Improve Software Usage

Samuel H. Russ

University of South Alabama

EXTENDED ABSTRACT

Often engineering classes require students to use specialized software. Instructing students how to install and use this software can be quite time-consuming. Conversely, online video (also known as "podcasting") provides a convenient format for documenting the necessary steps, as students can watch the video on their computer while they download, install, and use software.

A "training video" was developed for the installation and usage of software in an introductory microprocessor course. After deploying the podcast, the percentage of students successfully completing assignments that use the software increased dramatically, as did the average grade among students completing the assignment. Survey results from students were also very positive.

*625 – Not Presented

505 - Use of MathCad and Excel to Enhance the Study of Psychrometric Processes for Buildings in an Air Conditioning Course

Rogelio Luck and Pedro J. Mago

Mississippi State University, Department of Mechanical Engineering

EXTENDED ABSTRACT

The use of computational tools such as Mathcad or Microsoft Excel to increase the level of conceptual understanding of psychrometric processes in buildings in an air conditioning technical elective course is explored. By utilizing Mathcad and/or Excel students can be taught to create a set of psychrometric related functions that can greatly diminish the number of calculations required to tackle design-oriented problems. By doing this, two levels of conceptual understanding are enhanced. First students gain an appreciation of the basic psychrometric processes for buildings when creating specific functions in Mathcad/Excel, and second, students gain the ability to create automated worksheets for specific applications allowing them to see immediate results to variations in input design conditions as well as on different parameters. Feedback from students as well as class instructors demonstrates that the use of these tools enhance the student experience in an air conditioning class.

508 - Design, Development and Testing of Variable Pitch Propeller Thrust Measurement Apparatus - Freshmen Research Project

Adeel Khalid

Southern Polytechnic State University

EXTENDED ABSTRACT

The goal of this research project is to design, develop, and test an inexpensive thrust measurement apparatus and get freshmen undergraduate engineering students involved in the research. A variable pitch propeller is used to study the effect of changing pitch on the thrust. Some of the other variables studied include the blade rotational speed, rotor chord, span, twist and taper ratio. Motor speed and propeller pitch are controlled by separate electronic speed controllers. The effect of other variables i.e. rotor blade chord, span, twist, and taper ratio are studied by using separate blades of various specifications. Blades are designed using a Computer Aided Design (CAD) package and printed using 3D printer. The apparatus is designed to be robust enough to be used as laboratory equipment for future undergraduate students to conduct research projects. The apparatus will help students understand the principles of thrust and how various variables affect the thrust produced by propeller driven aircraft. The goal is to develop the entire system for minimum cost. Students get experience in designing the mechanical hardware, electrical hardware and software. Students conducting the experiments will be able to determine how the thrust varies as a function of the design parameters. Variable pitch propeller concept is used in single and multi-engine propeller aircraft, and turbine engine compressor blades. Undergraduate freshmen PSLSAMP (Peach State Louis Stokes Alliance for Minority Participation) students participated in this summer research project and decided to continue to work after the program was over. The design details, challenges, results and lessons learnt are discussed in the paper.

554 - Using IR Thermal Imaging to Engage Students in Campus Energy Awareness

Robert E. Choate and Thomas A. Choate

Western Kentucky University / Vanderbilt University

EXTENDED ABSTRACT

As many universities throughout the country are seeking to reduce energy losses inherent in decades-old buildings on their campuses, infrared thermography provides an avenue for determining which structures are in the most need of repair and specific areas of the structures that are most vulnerable to heat loss during the heating season and heat gain during the cooling season through the building envelope. In an effort to quantify some of these energy related issues, the Department of Facilities Management (DFM) contacted the Department of Engineering with an inquiry regarding available energy auditing resources. DFM had developed a building weatherization plan to address energy management issues across campus. The plan attacked the obvious areas of concern of energy losses/gains primarily through infiltration and exfiltration via failed window and door sealing components. The engineering department proposed the use of infrared thermography surveys and of differential pressure measure between the interior and exterior of the buildings scheduled for repair.

A before and after assessment approach was suggested to assess the benefit of the repairs. It was also decided that rather than faculty and staff performing the measurements that students would be trained and tasked with these building envelop measure responsibilities. An academic building on Western Kentucky University's campus, Grise Hall (GH) completed in 1966, was initially selected for this assessment since it was scheduled to have repairs performed to its Heating Ventilation and Air Conditioning System in fall 2010 and spring 2011, and weatherization repairs in summer 2012. Particular focus on GH was a known issue of exfiltration due to poor air balancing and subsequent loss of significant conditioned air through the enclosure resulting in possibly higher energy costs.

Through this study, it was shown that infrared thermography in the hands of student energy auditors formed a viable research tool in "visualizing" university campus building envelope deficiencies by providing quick assessment and presenting very discernible images. This technique was shown to effectively visualize air exfiltration in a university multipurpose building. The opportunity to apply infrared thermography to a campus-wide weatherization repair plan also provided DFM with an assessment of the benefits of their plan and identified additional areas of focus. The Department of Engineering, its faculty and students, benefited through the application of the technique to identify and verify the solutions to energy management issues associated with building envelopes. The University as a whole was the ultimate winner in this process through lower operating costs, greater cooperation between faculty and Facilities Management staff, and vested student interest in developing their knowledge and skills through their participation in a campus living-laboratory environment.

559 - The Use of Symbolic Solvers in Mechanical Engineering Education

R. Luck and B. K. Hodge

Mississippi State University

EXTENDED ABSTRACT

There are many books and pedagogical papers on how to use mathematical CAD programs to perform numerical calculations for engineering problems. In contrast to numerical calculations, this paper explores the use of symbolic solvers for mechanical engineering problems and investigates the pedagogical inferences of using these solvers in mechanical engineering education. Classroom explanations and homework for engineering courses sometimes require tedious symbolic manipulations of equations or systems of equations, differentiation of complex functions, and evaluation of integral expressions. The use of computational software systems, such as Mathcad, Mathematica, Maple, and Macsyma, capable of symbolic manipulations, allows the student to focus more on the engineering aspects of a problem than on performing the symbolic manipulations. With less time spent on evaluating integrals, performing complex differentiations, and solving systems of equations, more time is available for students to engage in higher-level synthesis and understanding. This article contains examples of using symbolic solves in several courses (the undergraduate level Engineering Analysis, System Dynamics, and Introduction to Vibrations and Controls courses and the graduate level Convective Heat Transfer course) in the Mechanical Engineering Program at Mississippi State University. These examples, taken from both undergraduate and graduate courses, illustrate how symbolic manipulation software can be successfully integrated in the classroom and in homework. Anecdotally, students appreciate the reduction of tedious algebra using symbolic manipulation software. The approach offers advantages in providing students with capability to solve more "real world" problems while concentrating on the engineering aspects of the problems. Although the examples in this paper are appropriate for mechanical engineering, the paradigm is transferable to any engineering discipline in which problem formulations result in systems of complex equations whose solutions require tedious (and error prone) manipulations.

588 - A Project-based Pedagogy in Teaching Robotic Mechanisms: Design a Remote Control All-Terrain Vehicle out of a Junky Car Chassis

Yan Tang and Charles Reinholtz

Embry-Riddle Aeronautical University

EXTENDED ABSTRACT

In this paper we will share our strategies for improving student engagement through a course design project in teaching robotic mechanisms at Embry-Riddle Aeronautical University (ERAU). In this project, students designed and constructed a remote control driving and steering system for a discarded all-terrain vehicle (ATV) chassis. This unique project-based learning experience has exposed students to practical issues in designing motion and motion transfer systems for wheeled vehicle. Through progress reports and weekly group presentations, we kept track of the project progress and helped them find and solve critical issues in time. Students successfully constructed a fully functional remote control ATV. The project was developed within the latest engineering education initiative CDIO (Conceive-Design-Implement-Operate) framework. The framework is intended to transform the focus of engineering education from the teaching of theory to building foundation for practice. At the conceive stage, students defined customer needs and developed conceptual design plan while being aware of the Design constraints. At the Design stage, students completed the part selection and the CAD drawings based on the conceptual design. During the Implement stage, learning activities shifted to manufacturing, installation, and testing. At the Operate stage, students should deliver the developed product to customers and provide maintenance and improvement if necessary. Due to the time constraint, students did not complete the Operate stage in this project. In conclusion, this teaching practice has successfully demonstrated that the project-based learning developed within the CDIO framework is very effective in engaging students in learning and improving their skills in design, teamwork, and communications.

Technical Session 3 Monday, April 3, 2012 3:40pm – 5:20pm

03:40 pm – 05:20 pm	T3-A Colvard Union 328	T3-B Colvard Union 329	T3-C Colvard Union 325	T3-D Colvard Union 330	T3-E Colvard Union 231
Technical Session 3	Instructional Division III	Engineering Tech. Division	K-12 Division II	Civil Eng. Division II	Professional Skills Division
Moderator:	*Claire McCullough*	*Jerry Newman*	*Beth Todd*	*Tanya Kunberger*	*Cindy Waters*

T3–A: Instructional Division III **Colvard Union 328**

T3–B: Engineering Technology Division **Colvard Union 329**

T3–C: K-12 Division II **Colvard Union 325**

* This abstract is a presentation only abstract without a full manuscript in the conference proceedings

*631 - Learning Activities for Each Stage of the Kolb Cycle

Joseph J. Rencis

Tennessee Technological University

EXTENDED ABSTRACT

The Kolb Cycle has been proven to be an excellent technique to improve student retention of complex numerical methods used to analyze engineering problems. The Kolb Cycle describes a cycle through which learning is achieved by various experiences. The Kolb Cycle displays four distinct stages called concrete experience, reflective observation, abstract hypothesis and conceptualization, and active experimentation. These stages are used in the development of knowledge within an individual through the experiences found in a stage. The four stages show some learning activities (experiences) that can be used by an instructor in each stage of the Kolb Cycle, e.g., concrete experience includes dissection, reverse engineering, and case studies. Even though the literature has shown that the Kolb Cycle can improve student learning, there has been minimal effort to identify and discuss in-depth learning activities for each stage of the Kolb Cycle. This presentation will present an in-depth discussion of learning activities for each for each stage of the Kolb Cycle. This paper will serve as a resource for inexperienced instructors who want to implement the Kolb Cyle for learning experience progression into their course to improve student learning.

582 - Student Assessments of Learning Objectives as a Study Tool

Joseph T. Coe Jr.

The Citadel

EXTENDED ABSTRACT

Learning objectives are a clear way to provide brief and explicit statements of expected student performance for a given subject matter. Their development is driven by the overall course objectives and they are utilized as a framework for evaluating student understanding and progress. This paper describes the adoption of new learning objectives within an upper-division, senior-level introductory geotechnical engineering course. As part of the study, the objectives themselves were evaluated by the students enrolled in the course to verify their overall efficacy as a study tool for the materials covered in the course. The students were allowed to comment on the learning objectives and provide feedback on their relative usefulness in preparing for course assessments such as exams. The overall consensus was that these students thought very highly of the learning objectives and felt the objectives were an effective study aid and benefited their experiences in the course. Though not measured directly prior to implementation of the study, anecdotal evidence from conversations with the students suggested they did not anticipate this level of course enhancement due to the use of learning objectives. Notably, the overwhelming majority of students in this study agreed with the notion that all courses should incorporate learning objectives into the curriculum. It is also clear that care must be exercised in generating the objectives and properly matching them to course assessments such as examinations and homework assignments in order to maximize their effectiveness.

599 - A Comparison of Tablet Computers for Use as a Class Presentation Platform

Thomas Murphy, Christopher Williams, Frank Katz

Armstrong Atlantic State University

EXTENDED ABSTRACT

The Apple iPad was the first multimedia tablet computer to gain wide market acceptance. Acer, ASUS, Hewlett Packard, Lenovo, Motorola, Samsung, Sony, Toshiba, and other manufacturers have subsequently released tablet computers. The paper provides an overview of currently available Android and iOS tablet computers, their advantages and limitations for use in presenting class material, recommendations for a minimum feature set when choosing a tablet computer for use as a class presentation platform, suggestions for how to use the tablet computer to deliver course material, and guidelines for how to prepare course material for presentation via a tablet computer. A comparison of Android tablets is presented with hardware and operating system specifications along with a discussion on the look and feel of the different tablets along with justifications for using the Samsung Galaxy Tab 10.1 as our primary Android testing device.

In this paper, we focus on the use of tablet computers as a classroom presentation platform rather than some of the many other uses marketed towards "typical" consumers. As these devices have become increasingly ubiquitous, more faculty members gain access to them and use them in the classroom. A faculty survey indicated that tablets were being used across campus to present slides, show web pages, draw/sketch, and play audio/video. After surveying students in four classes where the instructor is teaching using a tablet, it was found that the material presented using the tablet was as good as or better than with a laptop. Results of a faculty survey on how Armstrong Atlantic State University faculty are using tablets for instruction along with student impressions of their effectiveness for instruction are also provided. Based on student and faculty responses, tablet computers seem to be a viable and effective alternative for laptop or desktop computers when presenting material in the classroom.

606 - Using Student ID Numbers to Create Customized Homework Problems

Samuel H. Russ

University of South Alabama

EXTENDED ABSTRACT

Academic integrity and misconduct are of great concern in the educational community. One way to combat cheating is to assign each student a unique homework problem.

Student ID numbers are unique and can therefore be used to customize assignments. Using real examples from a logic-design course and a signal-integrity course, it can be shown how the creative use of ID numbers can create homework problems that are all equally difficult on one hand but unique on the other. One additional advantage is that future students who have copies of the old homework set have no special benefit versus students who do not have the old homework set.

In terms of generating answer keys, Microsoft Excel can "pick apart" the ID numbers to create answers for each student, and zeroes in the student ID number can be dealt with easily.

589 - Formulation and Development of the Wasson Systems Engineering Process Model

Charles S. Wasson

ASEE, INCOSE, and PMI

EXTENDED ABSTRACT

Introduction

During the past several decades, numerous attempts have been made to capture and communicate the highly iterative and recursive characteristics of the System Engineering process via graphical models. Examples include: the US Army FM 770-78, USAF AFSCM 375-5, MIL-STD-499, IEEE 1220, et al. Models to date: 1) are often considered abstract and 2) fail to include the essential elements that serve as the foundation for multi-disciplinary design collaboration and decision-making. Due to a lack of Systems Engineering (SE) education, project system development models – i.e., Systems Engineering Management – are often confused with SE Process Models. SE Process Models provide a problem-solving / solution-development methodology to translate abstract system requirements into the physical realization of a system. Unfortunately, the SE Management models are often used in capstone project courses with proclamations of applying SE methods to multi-disciplined, engineering teams.

Purpose

To overcome and correct deficiencies in current SE Process paradigms, this paper describes the formulation and development of a new SE paradigm, the Wasson SE Process model. The Wasson SE Process Model is explicit, easy to understand and communicate, and applicable to multi-discipline engineering design. The model features a robust, highly iterative and recursive, problem-solving / solution-development methodology that can be applied by multi-discipline engineering teams at any system level of abstraction or entity within each level of abstraction.

Methods

The paper's Introduction summarizes deficiencies of current Systems Engineering Process paradigm models and challenges in implementation in industrial environments. Using this backdrop, we formulate a Statement of the Problem and identify Model Success Criteria.

The structure of the model is derived from five (5) engineering team problem-solving / solution-development decisions concerning system / entity design and development. The decision sequences represent a process workflow consisting of Four Domain Solutions – i.e., requirements, operations, behavioral, and physical - with each derived from the preceding solution. For each of the five (5) decision making objectives, we identify steps of a methodology required to accomplish each objective. Based on analysis of the methodology steps, eight (8) entity relationship (ER) linkages are identified. The Four Domain Solutions and their linkages are then integrated into a graphical model.

Conclusions

The Wasson SE Process Model represents a paradigm shift to a new methodology that integrates current state of the practice methods, is easy to teach and communicate, is discipline-independent, and applies to multi-level systems, products, and services ranging from small to large and complex. The paper provides recommendations concerning instituting a Fundamentals of SE course as a pre-requisite to a capstone project course. This enables capstone course instruction to focus on its primary objective of applying accumulated education, knowledge, and skills to a real-world problem without being distracted with teaching SE concepts.

The paper concludes with a summary of how the Wasson SE Process Model satisfies Model Success Criteria to significantly strengthen the SE element of engineering education, produce engineering graduates who are better prepared to enter industry and perform multi-disciplinary SE, and enhance the engineering program's reputation for graduates with knowledge and skills highly recognized and recruited by industry, government, and academia.

527 – Not Presented

528 – Not Presented

603 - Mathematical Skills in Electronics Engineering Technology Curriculum

Zhaoxian Zhou

The University of Southern Mississippi

EXTENDED ABSTRACT

Professional Engineers, engineering programs are built on a foundation of complex mathematics and science courses; engineering technology programs provide students introductory mathematics and science courses, and only a qualitative introduction to engineering fundamentals. Engineering technology instructors as well as engineering technologists often focus on the applied and practical application of engineering principles, and thus lack foundation of complex mathematics and science courses. During the six years of engineering technology education experience, the author believes that introduction of higher level mathematics skills into engineering technology curriculum benefits the graduates in product design, testing, development, and systems development.

In this paper, extensive examples in circuit analysis, analog and digital communications systems are adopted to illustrate how higher level mathematics are incorporated into engineering technology curriculum. How to choose appropriate breadth and depth of the mathematics skills is discussed. Assessment results from direct and indirect methods are provided. Results show that well-planned integration of mathematics and techniques is efficient in creating a learning environment that nurtures critical thinking skills and development of technology expertise. Future work is also mentioned at the end.

576 - Youth Transportation Institute: An Undergraduate Research Initiative to Promote Transportation Engineering

Samantha Islam and Sarah Brown

Assistant Professor /Former Undergraduate Sudent

EXTENDED ABSTRACT

Studies show that fewer students enter into and persist in engineering degree programs than in other programs in the United States [Hossain, 2; Villiers, 3]. This problem is even more pronounced among minorities and students from low-income families. Civil Engineering, like other engineering discipline, is facing similar problem [Elton, 1]. One of the often cited reasons for the shortage of students in engineering program is the lack of knowledge and exposure to the opportunities in the engineering field [Villiers, 3]. Transportation engineering is a major sub-discipline of civil engineering. This branch of civil engineering is concerned with moving people and goods efficiently, safely, and in a manner conducive to a vibrant community. Transportation engineers specify, design, construct, and maintain transportation infrastructure which includes streets, canals, highways, rail systems, airports, ports, and mass transit. Therefore, for proper functioning of our society, there is a need for more talented and dedicated transportation engineers capable of maintaining our existing transportation infrastructure and designing and building new safe and efficient transportation facilities. Literature shows that there has been a decline in the number of transportation professional s [Wilkes, 4]. This decline can be attributed to the fact that the number of people retiring in this profession is more than the number of young people entering this profession. This paper describes an undergraduate research project that has been initiated at the University of South Alabama to motivate middle and high school students of Southeast Alabama to pursue future in transportation engineering profession.

540 – Not Presented

506 - Aerospace Engineering Camp for Youth – Techniques Used and Lessons Learned

Adeel Khalid

Southern Polytechnic State University

EXTENDED ABSTRACT

Aerospace Engineering (AE) is often thought of as 'Rocket Science' that is theoretical and difficult for an average student to understand. On the contrary AE is one of the special disciplines of Engineering in which theory is often developed based on the empirical results. There are several examples of both Aero and Space vehicles that were developed by trial and error. Aerospace Engineering in general is a discipline in which a lot of learning is done by hands-on, experimental, operational, observational, and exploratory techniques. These techniques can be taught and enjoyed by students of all ages (K-16). These techniques are explored in this study and their results are discussed.

One of the ways to motivate students to enter the field of engineering in general and AE in particular is through hands-on activities in educational camps. Two AE educational camps were held for middle and high school students at Southern Polytechnic State University (SPSU) in the summer of 2010, followed by three improved camps in the summer of 2011. Middle and high school students attended the camps at the same time but were separated in the room based on the age groups. The response was encouraging. A few field trips were arranged and guest lecturers were invited. Airplane, helicopter, and space shuttle models were used as training aids. Students participated in flight competitions including range and endurance competitions. Model rocket launch was one of the most well received activities. Model aircraft flights were enjoyed by students. The guest lecturer introduced students to Computer Aided Design (CAD) using state of the art software CATIA. The overall response from the participants was enthusiastic. Students enjoyed the hands-on activities and gave encouraging feedback. Several students expressed interest to return to the same camp the following year.

Hands-on, design, build, fly techniques, and visual and other tactile methods proved to be more educationally valuable than lecture-based sessions. Various techniques used to engage middle and high school students during the camp and the results obtained are discussed in this paper.

564 - University of Memphis Efforts Assisting US First Teams in Memphis City Schools A Year in Review

Daniel Kohn

University of Memphis

EXTENDED ABSTRACT

Back in 2008-09, Memphis City Schools (MCS) started a FIRST® Robotics Competition (FRC) Team in one of their high schools as part of an initiative to help increase interest in Science, Technology, Engineering and Math (STEM). This spread to six schools over the next two years, with further growth expected.

To help expand the program and to give students an opportunity to learn more about mobile robotics and engineering fields, MCS approached the Department of Engineering Technology at the University of Memphis to create a program to help further develop US First Robotics Teams within their high schools.

Along with providing technical support and helping find mentors from the University and Engineering community, The University of Memphis ran two programs for the MCS FRC Teams.

The first was a "Quick Build" to help the teams quickly assemble the "Basic Robot Base", the control system and driver station. This enabled the teams to have an early success and to ensure the teams could at least field a robot at the competition.

The second was a FRC Robotics Summer Camp, where students on various FRC teams learned more about FRC robotics for the 2011-12 robot build season.

This paper will cover the Quick Build and FRC Robotics Summer Camp, organization of the events, topics covered, lessons learned and how we hope to expand and to improve these events in the future.

*515 - The Business of Engineering – Leadership and Innovation Training for Future Engineers

Otsebele Nare, Ziette Hayes and Michael Reynolds

Hampton University/ Thomas Nelson Community College

EXTENDED ABSTRACT

A case-study based project for pre-college students that is facilitated by undergraduate engineering and business students is reported. Ninth grade high school students are introduced to engineering through a series of activities that emphasize the interdependence of business and engineering. Students are tasked with designing a microgrid for a university campus with a design stipulation that requires the integration of renewable energy resources. Students are divided into teams that receive initial training on small and short project activities to learn what it takes to function as a unit. In the case study, the participants had to take into consideration the population of the university campus (faculty, administration, students, etc.), the buildings and facilities, environmental effects, and finally the projected implementation cost of their electric energy system designs. The results of the case study designs had an integration of biomass, solar, wind, nuclear, hydro, etc. The presentation will discuss the projects that the students conceived as well as the merits of the projects including the methods and tools the students used to achieve their project goals. The project outcomes on cultivating problem solving skills, critical thinking, and creativity through teamwork, technology, small projects, and hands-on activities will be discussed. The program's preliminary results show that the approach of using the different activities helped in stimulating interest in the project. A summary of activities will be discussed to show how they were used to cultivate leadership and innovation including the emphasis on developing teamwork and communication. In addition, observations on the groups' leadership dynamics, and the project's potential impacts on participation of underrepresented groups in engineering will be discussed.

529 – Not Presented

558 – Not Presented

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592 - Data Organization and Management for the USM Neighborhood Stabilization Program

Tulio Sulbaran, Ph.D ; Travis Heathman

EXTENDED ABSTRACT

The Housing and Economic Recovery Act (HERA) of 2008 provided funds for several programs including the Neighborhood Stabilization Program (NSP). The Neighborhood Stabilization Program (NSP) purpose is to stabilize communities that have suffered from foreclosures and abandonment [1]. The NSP funds are being distributed nationwide by the U.S. Department of Housing and Urban Development (HUD) to areas hardest hit by the foreclosure crisis. The funds that have been distributed to Mississippi are administered by the Mississippi Development Authority which in turned made a request for proposal. The University of Southern Mississippi – Institute for Disability Studies, School of Construction and School of Computing submitted a project proposal and it was awarded a grant to rehabilitate over forty homes in the Jackson area in Mississippi.

As in all construction projects, an important aspect of the USM-NSP rehabilitation project is the data organization and management, which is the method of recording, organizing, and quantifying all activities on all phases of the building project life cycle. This important task was assigned the construction management team composed of a faculty, staffs and several students. This report summarizes the project based experience of students participating in this project. The students have been playing a key role in maintaining documentation of the construction activities and tracking all costs covered in the contracted scopes of work for all contractors involved. Activities consisted of preliminary quantity take-offs, price and cost researching, documentation of meetings and conferences held with all players involved within the contract, cost analysis, maintaining work schedules, and other organizational practices of the procurement documents. This experience is helping prepare students to step into a very competitive design-build construction company allowing them to play key roles in controlling the entire design and construction process from start to finish. This project has provided hands-on experiences to the students in managing a construction project. The experience of working on a construction management team for USM has allowed the students to network with professionals in the construction industry, and gain first-hand knowledge of social and communication skills that are common within the industry as well.

593 - Analysis of the Change Order Process for the Neighborhood Stabilization Program at the University of Southern Mississippi

Zachary Spear; Tulio Sulbaran, Ph.D

EXTENDED ABSTRACT

Change orders are the standard legal mean in the construction industry to modify contracts. A change order is a written agreement between the general contractor and the client to modify one or more aspects of a construction contract. The change order may include adding, deleting or modifying any aspects of the original construction contract including but not limited to scope, price, and timeframe among others. [Mississippi Legislature 2011]. Change orders are usually composed before or during the construction phase.

This report provides a student view on the similarities and differences of the change order process for the Neighborhood Stabilization Program at the University of Southern Mississippi (USM) and processes used by other organizations. The student worked with the construction team and learned details of the change orders process. The change orders process involved several steps including : 1- Identify the need to alter the construction project; 2-Compile all of the needed change order documents; 3- Analyze the content of the change orders; 4- Evaluate the effect of the change order on the project price/budget; 5- Estimate the impact of the change order on the project time; 6- Process for approval or denial of the changer order; and 7- Communication with the stakeholders

Processing change orders is an important skill in the construction industry because most construction projects at some point in time will have change orders and someone will have to address and act accordingly. The students had the opportunity to have hands-on experience and learn at USM. This process will be valuable to the students and will stay with them throughout their career.

Change orders are relevant to everyone involved in the project especially to the owner and the contractor. These stakeholders are affected the most because of their possible impact on price, time and/or operation of the facility. Change orders also affect the workers in that it changes their scope of the activities to be performed.

522 - Biomass Pyrolosis for Tar and Gas Production

David Domermuth

Appalachian State University

EXTENDED ABSTRACT

Wood tar, commonly called creosote, is as old as fire. The search for alternative energy has brought green research full circle back to this commodity. This paper describes the current research efforts at Appalachian State University with pyrolytic conversion of biomass to useful products. The current aspect of this project is the condensation of wood tar, green washed to be called biocrude. This process of biomass gasification has six potential revenue products and is the most likely candidate for economic viability; waste stream elimination, biochar production, biocrude production, heat, carbon sequestration, and fuel gas. The work is sponsored by an EPA, P3 student grant. The paper also reflects on student interaction and the merits of research based teaching.

Conclusions and future plans

Analysis of the BV system is a classical, applied chemical engineering application/problem; calculating the energy and mass balance to determine the operating efficiency. Two systems have been built and tested. BV1, for one gallon reactor, worked fine and proved that such a system was possible. The second system, BV30 was modeled after BV1 and performed adequately. BV30 included a furnace and barrels for condenser/heat exchangers. The output gas was almost smoke free. The first barrel warmed up but still condensed most all of the creosote while the second barrel remained cool. The flash back arrestor did its job, no explosions. Less gas was produced then expected but analysis of the reacted wood showed a lack of heat. The system was operated for one hour during which time it charred three pounds of wood, much less than expected. The next version will use more heat and an insulated furnace. This should produce the gas flow required to operate an internal combustion engine. The goal is production of sufficient gas to operate a genset. The input was about 50,000 BTU with about 8,000 BTU of gas produced and a pound of creosote. The next step is to redesign and run a measured test of mass change, temperatures, and gas output. A simple model will be used to create an equation around the parameters of, temperatures, inputs and outputs, to determine the energy and mass changes. This will lead to economic feasibility studies, return on investment calculations and hopefully implementation plans. All of this work is being conducted by a team of graduate and undergraduate students. It is a fantastic teaching through research environment. An additional goal is grant writing to fund continued research.

533 - Parsing the Content in Capstone Engineering Design Courses

Dr. Michael D. Boyette, P.E.
North Carolina State University

EXTENDED ABSTRACT

Engineering programs accredited by ABET must include a capstone course sequence to comply with ABET's criterion 3(c) and 4. In practice, students select a project and carry it through design to application. However, successful engineering requires more than technical expertise. If the essence of engineering is creativity and with design being the expression of creativity, how have departments adapted the capstone experience to the new student realities? ABET criterion 3(c), referred to above, is wholly devoted to including realistic constraints such as "economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability" into the capstone design experience. These are the so called "soft skills" without which, engineers are not likely ever approach their professional potential.

Perhaps we should make a thorough normative inventory (parsing) of the skills engineering graduates should acquire from the completion of the capstone experience and see how the typical undergraduate engineer curriculum could address them. Certainly on top of the list is all that is encompassed by the design experience but an effective professional needs more. The need for soft skills among engineering graduates is important and will grow continue to grow in importance. It is becoming increasing clear that what the engineering curriculum needs is a separate course dedicated specifically to the full range of soft skills. The body of knowledge that would constitute a soft skills course is extensive and too important to warrant attempting to plug it into odd spots of a course primarily about the mechanics of design.

What would such a course look like? Not only would the course include engineering ethics per the Canons of Professional Engineering but also content like that in "The Unwritten Laws of Engineering" by W.J. King which is really based on the finer points of the canons. To add practical substance and cautionary tales, there would be a place for case studies of engineering disasters and even those celebrated examples (e.g. LeMessurier) where engineering professionals did the right thing. The course content would certainly include the legal issues of engineering; especially product liability, a little of the history of engineering and even business etiquette. Some would argue that some of this content would better be addressed in an introductory engineering course but how can student fully apply soft skills to engineering knowledge they don't yet possess? This paper discusses and advocates the need for a separate course that emphasizes the soft skill as companion to the tradition engineering capstone design course.

565 - The Design Report: A Staged Approach

Rebecca K. Toghiani

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

EXTENDED ABSTRACT

Design reporting in the senior Process Design course is discussed in this paper. Class discussions allowed students to recognize the importance of each section of a design report, to identify who in the business/engineering organization might be most likely to read/review a particular section, and to identify specific elements that were critical to formulation of a particular section. With multiple projects completed over the course of a semester, it was possible to include only 3 to 4 sections in the first design report (selected by the instructor). Each subsequent report incorporated additional sections. The final project report included all sections typically found in an engineering design report. This staged approach to design reports has benefits realized by both the students and the instructor. The staged approach, where emphasis was placed on specific sections of the report, allows students to hone their skills in reporting/crafting each specific section. They also were able to incorporate feedback from previously submitted reports on relevant report sections. This approach also benefited the instructor through focused grading activities and reduced load as the instructor had to focus attention primarily on those sections new to the given project/report. Those sections that were not new to the specific report were typically of higher quality and required little critique as students had successfully incorporated feedback from the graded previous report. This approach could be implemented in any senior capstone design course or laboratory course where multiple projects/reports are performed over the course of a semester.

Keywords: Design reports; capstone design, communication skills, student teams, chemical engineering

574 - The Evolution of an Assignment: Using a Technical News Story as a Writing Prompt

John Brocato

Bagley College of Engineering, Mississippi State University

EXTENDED ABSTRACT

Engineering instructors without a research background or research agenda sometimes struggle to come up with substantive new assignment material. Requiring students to provide their own subject matter, while mutually beneficial in many ways, has several limitations, all of which are exacerbated when the instructors come from different educational backgrounds than the students. Thus, instructors in this situation must be vigilant about looking for new raw material. Instructors in GE 3513 Technical Writing, a junior/senior-level engineering communication course, discovered the following statement in *Harper's Magazine*'s "Weekly Review" for Tuesday, July 26, 2011: "Korean scientists determined that the shaking of a Seoul skyscraper, which shut down the building for two days, was caused not by an earthquake but by a Tae Bo class in the building's gym." One logical non-expert reaction to this sentence is, "How could what must be a relatively small number of people create an earthquake-like effect so distinct that it forced a building's closure for two days?" This seeming disparity – a small group of people creating a seismic phenomenon – along with the opportunity for communicating the science behind the disparity is what makes this one-sentence news story an excellent candidate for a useful writing assignment. This paper, then, discusses how instructors with an English/writing background who teach an engineering-communication course used this story as the basis for a new assignment and implemented the assignment for the first time (complete with samples of student responses). The paper seeks to answer five research questions about the story's use:

1. How would the students verify the story's accuracy? Would any of them be *unable* to verify the story's accuracy?
2. What sort of techniques would students use to describe the science underlying the phenomenon?
3. Would the students' descriptions differ from one another, and, if so, how much?
4. How would non-technical instructors know whether the students' scientific descriptions were accurate?
5. How much would the students from "non-structural" majors – biological, chemical, computer science, and so on – be able to contribute to their teams' solutions? Would they learn anything from their more structurally inclined peers?

The paper closes with a discussion of future steps in the evolution of this topic.

*617 – Paper Withdrawn

*632 - Course Development – Preparing Graduate Students in Proposal Preparation and Other Aspects of the Academic World

R. Mark Bricka and Adrienne Minerick
Mississippi State University/ Michigan Technological University

EXTENDED ABSTRACT

In 2009 a new course was developed at Mississippi State University (MSU) designed to guide graduate students through the proposal perpetration process. Originally this course was developed for the purpose of a proposal-base qualifying exam process for the School of Chemical Engineering at MSU. In 2009 a paper by Minerick and Hernandez was presented to ASEE detailing the specifics of this first time offering of this course. In 2010 this course was modified to allow graduate students of any scientific or engineering discipline to take the course.

The modified course was focused to address the needs of first or second year Ph.D. graduate student in the details and mythology of assembling a technical proposal and preparing this proposal for review by a committee of 4 professors. The course involved detailed instruction on issues such as:

- conducting a review of relevant literature,
- seeking potential funding agencies,
- budget preparation,
- preparing a proper objective/hypothesis statement,
- addressing the technical merit of the concept,
- addressing the broad impacts of the research, and
- the review process.

This course culminated in a 15 page NSF style research proposal and a 30 minute oral proposal defense.

As part of this effort, evaluations of each student were conducted by the committee members. In addition, a series of surveys were presented to each student, and committee member to assess the effectiveness of the course in achieving the course goals. All surveys, procedures and tools were approved my MSU's and Michigan Technological University's Institutional Review Board.

This paper will briefly describe the evolution of the course over the past three years from a chemical engineering focus to its current broader focus. The paper will present course details and survey results and a final assessment of the coursed effectiveness.

Keywords: Graduate Course, Chemical Engineering, Proposal, Research, Education

Technical Session 4 Tuesday, April 3, 2012 9:20am – 10:20am

9:20 am – 10:20 am	T4-A Colvard Union 328	T4-B Colvard Union 329	T4-C Colvard Union 325	T4-D Colvard Union 330	T4-E Colvard Union 231
Technical Session 4	Service Learning	Electrical Eng. Division	Chemical Eng. Division II	Software Eng. Division I	ASEE: Year of Dialog
Moderator:	*Sally Pardue*	*Zhaoxian Zhou*		*Donna Reese*	*Doug Tougaw*

T4–A: Service Learning **Colvard Union 328**

512 - Civil Engineering Service Learning Projects: Local and Global Perspectives 2-80
William J. Davis, Thomas R. Dion

612 - Using Experiential and Constructivist Teaching Pedagogies in Undergraduate Teaching 2-81
Islam H. El-adaway, Dennis D. Truax

583 - Developing Global Perspective through Service Learning 2-82
Sirena Hargrove-Leak

T4–B: Electrical Engineering Division **Colvard Union 329**

571 - Teaching Energy Conversion – A Case of Electrical Engineering Students Self-Assessing Performance Outcomes 2-83
Otsebele Nare

607 - Teaching a Cross-Disciplinary Nanocomputing Systems Course 2-84
Waleed K. Al-Assadi, Aurangzeb Khan

624 - Suggested Course in Multi-Disciplinary Renewable Energy Management 2-85
M. Y. El-Sharkh, A. Rahman

T4–C: Chemical Engineering Division II **Colvard Union 325**

534 - NanoExposed! – Chemical Applications in Nanotechnology 2-86
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*604 - A Systematic Sequence for Computing Velocity Profiles in Elementary Viscous Flows 2-87
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562 - The Use of Energy Modules as a Mechanism to Introduce Sustainable Engineering and Improve Retention of Chemical Engineering Undergraduate Students at Mississippi State University 2-88
Jason M. Keith, Bill B. Elmore, W. Todd French, Hossein Toghiani, Rebecca Toghiani

T4–D: Software Engineering Division I **Colvard Union 330**

T4–E: ASEE: Year of Dialog **Colvard Union 231**

512 - Civil Engineering Service Learning Projects: Local and Global Perspectives

William J. Davis and Thomas R. Dion

The Citadel

EXTENDED ABSTRACT

Ethical cannons of the engineering profession require civil engineering graduates be principled leaders through the crucial role they will play in planning, design, and construction of the built-environment needed to establish safe, healthy, equitable and vibrant communities. These ideals are reflected in a national academic movement to include "service learning" as a crucial educational component of the undergraduate curriculum. The Citadel's service learning initiatives in civil engineering are aimed at engaging students to participate in data collection and analysis of local infrastructure projects. These experiential learning projects are commonly performed on behalf of local government and have been effective in providing meaningful and lasting contributions to the local community, forging enhanced partnerships between the college and community, and creating valuable lessons in educating tomorrows' leaders through hands-on experience on how to institute change. Through participation in these opportunities, students gain first-hand knowledge of engineering practice, actively contribute to their community through the service they perform, and develop a personal appreciation for civic responsibility.

Keywords: Service Learning, Experiential Learning, Community Service Projects,

612 - Using Experiential and Constructivist Teaching Pedagogies in Undergraduate Teaching

Islam H. El-adaway and Dennis D. Truax
Mississippi State University

EXTENDED ABSTRACT

This paper shows how problem-based-learning (PBL) and learning-through-service (LTS) can provide a strong framework for fostering students' adaptive expertise, flexibility, creativity, innovation, and passion in the classroom. Mississippi State University (MSU) represented by its Civil and Environmental Engineering Department (CEE) is currently in the design-development stage for the construction of a new Civil and Environmental Engineering Complex (CEEC). CEE is garnering a new focus on sustainability with special emphasis on environmentally responsible design, construction, and operation of constructed facilities. The authors have mentored a group of 22 undergraduate junior students under the High Performance Sustainable Construction class to provide a comprehensive Leadership in Energy and Environmental Design (LEED) analysis for the new CEEC using the 2009 Reference Guide for Green Building Design and Construction, The student work shows that CEEC can possibly earn up to 74 points to acquire a Gold LEED Certification. This study shows that PBL and LTS can significantly enhance students' abilities of understanding and solving complex real world civil infrastructure problems and challenges. Also, this student-driven teaching approach instills creative learning environment, understanding of the surrounding world, and a sense of social responsibility.

Keywords: *LEED, Sustainable Sites, Water Efficiency, Energy and Atmosphere, Materials and Resources, Indoor and Environmental Quality, Problem-Based-Learning, and Learning-Through-Service.*

583 - Developing Global Perspective through Service-Learning

Sirena Hargrove-Leak, PhD

Elon University

EXTENDED ABSTRACT

The ASEE Report "Engineering Education for a Changing World" addresses the need for engineering educators to engage in engineering outreach and the need for engineering programs to include opportunities for engineering students to develop skills necessary to be successful in the changing workplace. The global reach of engineering is included in the list of desirable skills. A carefully crafted service learning project can address both needs.

One approach is to use the Engineering is Elementary® units developed by and available from the Museum of Science in Boston. Each unit includes a storybook featuring a character(s) from one of a variety of cultures and backgrounds who is confronted with a problem. The curriculum materials accompanying the storybook then guides the users through a hands-on engineering design challenge to solve the problem encountered by the storybook character(s). Units also include tools to assess learning. Units are designed for students in Grades 1 through 5 and defined by science topic and engineering discipline. Therefore, they are perfect for undergraduate engineering service learning projects. The global nature of the units is an added bonus that supports the development of both student groups by broadening their perspective.

Preliminary qualitative data from a service learning partnership between an Engineering Thermodynamics class and a select group of 4^{th} and 5^{th} graders show that the Engineering is Elementary® curriculum is an effective tool for learning for all of the students. The presenter will also discuss implementation and execution tactics aimed at inspiring others to use this approach.

571 - Teaching Energy Conversion – A Case of Electrical Engineering Students Self-Assessing Performance Outcomes

Otsebele Nare

Hampton University

EXTENDED ABSTRACT

This paper deals with analyzing student performance outcomes of an electrical engineering core-course in energy conversion by tracking student perceptions and correlations with changes in delivered technical content between 2008 and 2010. Outcomes from the final comprehensive exams were compared to the student self-assessment survey results. The outcome assessment was done based on performance in questions relating to (1) dc motors and electromechanical energy conversion system principles, (2) ac machines and power flow diagrams, (3) transformers and equivalent circuits, and (4) three-phase circuits. The student self-assessment surveys given prior to final exams combined the concepts taught in the course and general feedback on the course instruction. The questions included a measure of confidence in applying basic principles learned in the course and identifying different systems to apply the electromechanical energy conversion principles. The analysis also checks the potential validity of self assessments as a formal assessment instrument. The results of the study showed that the self-assessments offered comparable results to the results of the formal assessment methods.

607 - Teaching a Cross-Disciplinary Nanocomputing Systems Course

Waleed K. Al-Assadi and Aurangzeb Khan

University of South Alabama

EXTENDED ABSTRACT

The end of photolithography as the driver for Moore's Law is predicted within few years. Emerging nanotechnology is expected to replace the current CMOS-based system integration paradigm. As promising nanotechnology is emerging and to continue the technological revolution, there is a strong need for preparing well-educated future engineers in nano-based computing systems design. This paper presents a framework for a cross-disciplinary course in nanocomputing systems by introducing two emerging technologies: Crossbar-based Nano-Architecture and Quantum-Dot Cellular Automata (QCA). The goals of the course are to introduce our students to the design trends of computing systems in the nanotechnology era and provide them with necessary knowledge and skills that will make them highly competitive in future engineering jobs market. The course will be offered for both undergraduate seniors and graduate students.

624 - Suggested Course in Multi-Disciplinary Renewable Energy Management

M. Y. El-Sharkh and, A. Rahman

University of South Alabama

EXTENDED ABSTRACT

Due to the high rate of fossil fuel consumption and depletion of traditional energy sources, a global energy crisis is estimated to occur within the next 60-100 year. The quest for a new energy sources has necessitated the deployment of renewable sources of energy. This has brought to the forefront the need for effective management of both traditional and non-traditional sources. Preparing engineering students to fully understand the nature of the impending crisis and be equipped for it is therefore imperative. In this paper the authors propose a multi-disciplinary course in energy management in the Electrical and Computer Engineering curriculum. Therefore, the objective of the course is to introduce to the undergraduate and graduate students, state of the art energy management principles and algorithms. The proposed course will cover many concepts of the available renewable energy sources management techniques. In addition, the application of artificial intelligence techniques such as evolutionary programming, and artificial immune system in energy management will be introduced. This course will be offered as an advanced level course following the introductory renewable energy course that the authors are currently teaching in the Electrical and Computer Engineering Department. In addition to graduate and undergraduate students, the proposed course is expected to attract engineers from the local industry as well.

534 - NanoExposed! – Chemical Applications in Nanotechnology

Priscilla Hill

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

EXTENDED ABSTRACT

As part of an NSF NUE grant, the introductory seminar course NanoExposed! was developed to introduce freshmen to basic concepts in nanotechnology. The goal is to introduce entering engineering and science student to nanoscience in a way that gets them excited about the field. The course was taught for the first time during the Spring 2011 semester and for the second time during the Fall 2011 semester. This presentation will focus on the chemistry and chemical engineering portion of the course. However, given the interdisciplinary nature of nanotechnology, there is overlap with other fields.

Many of the examples presented explain the differences in properties between the bulk scale and the nanoscale and how these differences are being used commercially. For example, the size of particles in a clear material determines whether the material is opaque or translucent. This has been used with zinc oxide in sunscreens to make the sunscreens transparent. Other topics covered include fabricating nanoparticles or other nano-structures, "seeing" or characterizing nanomaterials, and applying nanotechnology in common commercial products. In addition to current uses, possible future uses are discussed. The presentation will focus on course topics and resources used.

*604 - A Systematic Sequence for Computing Velocity Profiles in Elementary Viscous Flows

Rocío Tíjaro-Rojas / Mariano Amicarelli / Pedro E. Arce
Chemical Engineering, Tennessee Technological University, Cookeville, Tennessee

EXTENDED ABSTRACT

Viscous flows are a fundamental part of fluid mechanics and momentum transfer in any engineering degree; and most would agree that they bring a very challenging task to students. Textbooks commonly used to teach these subjects, do not offer students a logical and detailed approach to derive a plausible solution. Students frequently become frustrated when confronted with a challenging problem because conventional teaching methods incorporate confusing hidden assumptions to drive the calculation, instead of recalling familiar concepts from calculus, mass balance and momentum conservation. This situation is further complicated when students cannot, for example, identify a proper location for the coordinate system origin, or why one coordinate system is better suited than others.

Here, we describe a systematic and learning-based sequence for the calculation of fluid velocity profiles; this sequence clearly utilizes the students' knowledge and assists them in building an effective and efficient path to successfully obtain any velocity profile and its validation.

Initially, the student following our sequence sets up or distinguishes the geometry of the control domain. Following that step, a convenient coordinate system is chosen and logically anchored to simplify any existing symmetry within the control domain. Once that is complete, all assumptions of the control domain must be identified to then categorize the fluid and state all applicable properties of said fluid. The next step is to propose the kinematics of the system. The last thing that the student must identify is the type of flow or the driving force of the flow in the control domain, before recalling the Navier-Stokes equation. Up to this point of the analysis, the student has only tapped into the knowledge, comprehension and application categories of Bloom's taxonomy's cognitive domain, without any utilization of concepts related to conservation of total mass and momentum. Moving onto the analysis and synthesis categories, the student must recognize the boundary conditions present in the system and reduce the Navier-Stokes equation to only the applicable terms incorporates the information collected during the previous steps. After the differential model is specified and boundary conditions are selected, the final solution is obtained and verified. The authors will discuss details and illustration about the sequence as well as limitations and pedagogical reasons.

Future efforts will include the study of the pedagogical effects on student learning by comparing traditional approaches to the one described in this contribution.

562 - The Use of Energy Modules as a Mechanism to Introduce Sustainable Engineering and Improve Retention of Chemical Engineering Undergraduate Students at Mississippi State University

Jason M. Keith, Bill B. Elmore, W. Todd French, Hossein Toghiani, and Rebecca Toghiani

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

EXTENDED ABSTRACT

In our recent economic times, chemical engineering departments are faced with the need to improve retention to justify appropriate use of state and federal funding. At Mississippi State University, we are investigating ways to spur student interest using active learning methods as a means to improve retention and student interest in chemical engineering as a profession. This is being accomplished through the use of energy modules, many of which are applied to hydrogen production or hydrogen use in fuel cells. The introduction of energy technology provides us with a mechanism to apply the chemical engineering fundamentals to a broad problem in sustainable energy production and use. Since most chemical engineering students want a career where they can help others, the sustainability theme immediately gets their attention.

This paper describes the use of energy modules in the chemical engineering curriculum at Mississippi State University. These modules are being integrated throughout the core courses in the freshman, sophomore, junior, and senior years and also in an elective on hydrogen energy. The paper outlines efforts in the mass and energy balances course, the engineering materials course, and the chemical engineering reactor design course. The intent of the modules is multi-faceted. The modules show a connection between traditional chemical engineering fundamentals and applications to real world energy problems. This includes showing the impact that a chemical engineering education can have on both domestic energy independence and on worldwide energy availability, as well as in the stewardship of energy resources. We plan on assessing the impact of sustainable energy course content on student interest in chemical engineering as a career and in student retention to graduation.

535 - Meeting Quality Demands: A Case for Improving Non-Functional Requirements Literacy

Janet T. Jenkins and Randy K. Smith

University of North Alabama / University of Alabama

EXTENDED ABSTRACT

This brief report studies the perceived importance of functional requirements and non-functional requirements by university SE/CS students, SE/CS faculty and practicing professionals. The study centers on these communities' view of non-functional requirements. The contrast is stark and points to the need for SE/CS education to not only increase the depth of coverage but also emphasize the importance of NFRs to the overall success of a software effort. Of course not all SE/CS programs share the same emphasis. This paper provides anecdotal evidence to persuade or reinforce based on a programs current leaning.

544 - Women in Software Requirements Engineering: An Exploratory Study

Kendra Carr and Nan Niu

Department of Computer Science and Engineering, Mississippi State University

EXTENDED ABSTRACT

In an era when women are increasingly prominent in disciplines like medicine, law, and business, the engagement of women in engineering has yet to reach its potential. One way to facilitate the recruitment and retention of women in engineering education is to introduce internationally renowned women engineers and scientists as role models. This paper presents an exploratory study on the roles women researchers play in the field of software requirements engineering (RE). RE draws on the cognitive and social sciences to provide both theoretical grounding and practical techniques for eliciting and modeling requirements. As a result, RE is inherently interdisciplinary and contributions can be made by researchers (especially women researchers) with diverse expertise, such as cognitive psychology, sociology, linguistics, computer science, and so forth. In this study, we explore the roles women play in RE by examining three well established women researchers in the field. Our study identifies trends and hypotheses to guide further investigation. The results can be readily adapted as recruiting notes or training materials for improving the engagement of women in engineering in general.

560 - Evolution of the 100 Problems Curriculum of Computer Science

Xiaoyan Hong, John C. Lusth, Nicholas A. Kraft and Debra M. McCallum

The University of Alabama

EXTENDED ABSTRACT

The 100 Problems (100P) approach to a Computer Science curriculum radically departs from traditional classroom-based learning formats. It incorporates aspects of related innovative teaching strategies and methods to offer the entire curriculum with problems that can be tailored to the interests of the participating students and faculty. Typically, 100P is formed around 100 concept- and research-related problems through nine core courses in normal computer science curriculum. For each of the required and elective courses, students are given nine problems to solve for that semester. These problems guide students in their discovery of the subject area so as to gain fundamental knowledge and skills. The students interact with and demonstrate the solutions to a mentor. The 100P curriculum is a program of guided discovery in nature and aims to strengthen the self-motivation and self-reliance of undergraduates.

In the past two years, four cohorts of the students have been enrolled in the 100P program and have been studied. The students from the senior cohort are now approaching graduation. Various components in the 100P have been modified, over time, to improve institutionalization. Furthermore, our experiences offering courses in this format have been shaped from dealing with emerging challenges each semester. During the study, we have also received continuous feedback on the program through assessments. In this paper we will first introduce the 100P program and then describe our experiences and resulting strategies. The challenges and strategies include qualifications, time management, and developing a systematic concept repository. We will also report the evaluations and findings with these perspectives. We hope to offer a view that depicts the evolution path of the program towards the future.

Technical Session 5 Tuesday, April 3, 2012 10:40am – 12:00pm

10:40 am – 12:00 noon	T5-A Colvard Union 328	T5-B Colvard Union 329	T5-C Colvard Union 325	T5-D Colvard Union 330
Technical Session 5	Instructional Division IV	Administrative Division III	Research Division	Software Eng. Division II
Moderator:	*Tim Wilson*	*Priscilla Hill*	*Tom Fallon*	*Willard Munger*

T5–A: Instructional Division IV **Colvard Union 328**

619 - Power to the People: Energy Audits 2-94
Monika Bubacz, Philip McCreanor, Laura Lackey

600 - Development of a Structured-Inquiry Module for Teaching Sustainability 'Around the Cycle' 2-95
Mary Katherine Watson, Caroline Noyes, Michael Rodgers

549 - Teaching Sustainability in an Interdisciplinary Environment 2-96
Qiong Zhang, Delcie Durham, Alcantar Norma

577 - Teaching Higher on Bloom's Taxonomy: Experience in Introduction to Graphical Communication Course 2-97
Lulu Sun, Christopher Grant

T5–B: Administrative Division III **Colvard Union 329**

566 - Travel Behavior of Students Reaching Their Origin and Destination at the University of Florida 2-98
Vaibhav Nayar, Fazil T. Najafi

597 - ~~Developing New Technology-Related Bachelor Programs in the Middle East~~ Not Presented 2-99
Khaled Hamad, Maher Omar, Abdullah Shanableh, Yahya Sarraj

*570 - Enhancing International Recruitment, Teaching, and Research: The Colombia and Malaysia Connection 2-100
Jairo Diaz-Ramirez, James Martin, John Ramirez-Avila

*622 - MoLE-SI: A Mobile Learning Environment for Engineering Education 2-101
M. Pazos Revilla, R. Asher, J. J. Biernacki, P.E. Arce

T5–C: Research Division **Colvard Union 325**

613 - Ethical Concerns in Engineering Publications 2-102
Marianne Jennings, Islam H. El-adaway

595 - Survey Practices implemented in an MDOT Project 2-103
Alazar Tsegaye, Tulio Sulbaran

* This abstract is a presentation only abstract without a full manuscript in the conference proceedings

T5–D: Software Engineering Division II **Colvard Union 330**

619 - Power to the People: Energy Audits

Monika Bubacz, Philip McCreanor, Laura Lackey

School of Engineering, Mercer University, Macon, GA

EXTENDED ABSTRACT

Energy is one of the most fundamental parts of our lives. Energy keeps us comfortable, heats water, preserves food, provides artificial light, and keeps television, computers and other appliances running. All of this requires a lot of energy: households consume nearly one-fifth of the total energy used in the United States each year. Home energy use contributes 20% of the nation's annual CO_2 emissions from fossil fuel combustion. Thus, finding ways to use less energy more efficiently is important to reducing our climate impact. An energy audit is an inspection, survey and analysis of energy flows in a building, focused on reducing the amount of energy input into the system without negatively affecting the outputs. The Mercer University School of Engineering received two grants to support three energy audits performed by engineering faculty members and their students in the neighboring community. The goal of the project was to prepare the faculty for the inclusion of service-learning projects in their courses and to engage students in environment-saving practices. The audit tasks included surveying the: building envelope, HVAC, water, lighting, equipment, landscaping and waste / recycling. The findings of each audit were summarized in a report that included recommendations to make the audited buildings more energy efficient and environmentally friendly.

The paper provides general information about types of energy audits and their components, as well as resources for training, standards, do-it-yourself procedures, and report templates. Additionally, a list of necessary equipment and tools purchased, an audit outline used, and a summary of the most important finding for two audited locations is made available.

The project prepared four Mercer Engineering faculty members for the inclusion of service-learning projects in their courses, involved students, and provided a plan for the reduction of the environmental footprint of buildings in the neighborhood surrounding Mercer University. The energy audits performed by students, as service-learning ventures, provided a unique learning environment and fostered the developing new skills. After each audit, a report was produced that summarized the findings of the team that can be used to make the buildings more energy efficient and environmentally friendly. Energy audit projects actively engage and motivate students, which may improve learning. The project created a stronger connection among students, faculty, and the community and will ultimately reduce the environmental impact of the College Hill neighborhood while reducing the utility bills associated with these buildings.

The authors anticipate that energy audits will be added to engineering curriculum as a lab activity or lecture topic and student projects in selected energy and environmental sustainability related courses. There is also a prospect of weatherization projects conducted in cooperation with Macon Area Habitat for Humanity.

600 - Development of a Structured-Inquiry Module for Teaching Sustainability 'Around the Cycle'

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EXTENDED ABSTRACT

Introduction

Sustainable engineering has emerged as a field aimed at balancing economic, environmental, and social systems during development. For engineering to contribute to sustainability, curricula reforms are needed to train sustainability-conscious engineers. The goal of this project was to apply learning theories in development of a structured-inquiry sustainability module that can be used to integrate sustainability into existing capstone design courses.

Theoretical Framework

The sustainability module was designed to incorporate inquiry learning and learning-cycle-based instruction, which are pedagogies supported by constructivist and experiential learning theories. Inquiry teaching is an inductive method that uses problems to provide a context for learning. In structured inquiry, students are given a problem and guidelines for how to solve the problem. Learning-cycle-based instruction provides opportunities for students to engage in all four phases of Kolb's learning cycle.

Module Development and Dissemination

The three-part module was developed to guide student groups in learning about and applying sustainability principles. In Part 1, students become experts on a sustainability theme and develop a mini-lecture to teach group members about their topics. During Part 2, student groups identify application of sustainability concepts in case studies, while in Part 3 students complete a sustainability assessment for their capstone project. A module workbook is provided to help students self-navigate through the module, with the course instructor serving only as a facilitator.

Module Implementation

The module, which requires approximately nine hours of class time for implementation, is designed to be integrated into CEE capstone design courses. However, minor adjustments to the module workbook can be made to make the module appropriate for other engineering courses.

Conclusions

Though the proposed sustainability module cannot alone transform an undergraduate curriculum, it can be used to supplement other sustainable education initiatives. Since current students will soon be the principal agents responsible for project design, it is critical that engineering curricula train them to engage in sustainable design.

549 - Teaching Sustainability in an Interdisciplinary Environment

Qiong Zhang, Delcie Durham and Alcantar Norma

University of South Florida, Department of Civil & Environmental Engineering Department / University of South Florida, Department of Mechanical Engineering / University of South Florida, Department of Chemical & Biomedical Engineering

EXTENDED ABSTRACT

There has been an increasing articulation of the need for student training that includes the consideration of sustainability. However, many challenges remain to the successful delivery of an integrated sustainability education within engineering. One of challenges is the lack of an established pedagogy for teaching involving multidisciplinary topics. Creating the appropriate interdisciplinary environment is critical for sustainability education to enhance the ability of students to grasp the concepts of sustainability science, materials design and green engineering and to apply the principles they have learned to solve real world problems.

At the University of South Florida (USF), several sustainability related courses have been offered in the College of Engineering, such as "Sustaining the Earth: Engineering Application" from Chemical and Biomedical Engineering (CBE), "Green Engineering for Sustainability" from Civil and Environmental Engineering (CEE), and "Sustainable Design & Materials" from Mechanical Engineering (ME). In the past, these courses have been offered in the individual departments. In spring 2011, the instructors of these courses consolidated them into one interdisciplinary course. This paper introduced the process of initiating this interdisciplinary course and examined the successes and failures of an integrated team teaching method.

The common syllabus for this interdisciplinary course was developed based on previous course structure. The tailored course package was compiled by the instructors from various sources including peer reviewed journal articles, chapters from books, reports, articles from public domain. The three instructors were committed to co-teaching the course, not just dividing the course into individually taught modules. For assignments, all instructors contributed to problems that were designed to relate to the real life. The interdisciplinary student teams were formed to work on the group projects related to sustainability. The integrated team teaching was assessed through instructor self evaluation and student evaluation. It was found that the breadth of topics covered in this interdisciplinary course and the integrated team teaching have high potential to educate students in the field of sustainability. However, some criticisms were raised from student evaluations including large class size, uneven transitions between different topics, lack of communication, unclear expectations, inconsistent homework grading and mixture of graduate and undergraduate students. Such integrated team teaching may be improved by creating a hybrid combination split between large common lectures focusing on the concepts and tools and smaller class lectures and exercises focusing on application within the different disciplines.

577 - Teaching Higher on Bloom's Taxonomy: Experience in Introduction to Graphical Communications Course

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EXTENDED ABSTRACT

Bloom's taxonomy is a commonly accepted taxonomy of cognitive skills, that is based on the level of student understanding necessary for achievement or mastery. The system can be used to evaluate the objectives of the course curriculum and class activity. Introduction to Graphical Communications is one of the largest classes taught in the Freshmen Engineering Department at Embry-Riddle Aeronautical University, with an average enrollment of 500 students a year. The course is designed to familiarize the student with the basic principles of drafting and engineering drawing, to improve three dimensional visualization skills, and to teach the fundamentals of a computer aided design program (CATIA). Much of the teaching is focused on knowledge and comprehension, low levels of Bloom's taxonomy. Faculty members show students step by step how to build a model and make sure they can follow and understand the procedure. However, students' ability to use this knowledge and comprehension to explore real engineering design is unknown.

This paper includes the implementation of Bloom's taxonomy in the Introduction to Graphical Communications course, and shows how students are moved up Bloom's taxonomy by changing previous individual final project to group final projects. Instead of following faculty member's instruction to complete the model design, students are required to form the team, research the product they want to design, design their power point, and present their work as a team. The team project enables and challenges students to work on the higher levels of Bloom's taxonomy by emphasizing teamwork, exploring real engineering design problem, and enhancing their oral and written skills. The results suggest that taking Bloom's Taxonomy into account in course design is worthwhile.

566 - Travel Behavior of Students Reaching Their Origin and Destination at the University of Florida

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University of Florida / University of Florida

EXTENDED ABSTRACT

The primary objective of this research is to investigate the travel behavior of students reaching their origin and destination at the University of Florida. University of Florida is located in the city of Gainesville, Florida with a population of over two hundred thousand people. There are more than fifty thousand students at the University of Florida studying undergraduate and graduate work. A study using large- scale travel surveys were conducted throughout the University of Florida campus. The travel behaviors of students from the surveys were analyzed, primarily of students that used a motorized vehicle for means of transportation for short distances (less than or equal to 3 miles). Taking the age of university students into consideration (18 to 24 years), the distances were appropriately converted into steps to appraise the potential physical activity benefits of making these short trips by foot instead of a motorized mode of transportation.

After analyzing the travel behavior of the students, primarily of those that used motorized vehicles, estimation and analysis were done on the health benefits students would have by trading their motorized vehicles for a non- motorized mode of travel such as walking to make their short trips. For this purpose, results show that 91% of the student body at the University of Florida uses the Regional Transit System for their transportation to their on campus destinations, while 82% of the population walks or bikes to campus and 33% drive their motorized vehicles. This paper will discuss how to get the last 33% of the students to adapt a sustainable way to travel to campus and its benefits both to them individually and university as a whole. This shift in the mode of transportation for University of Florida students could help them meet the required physical activity an individual needs for a healthy lifestyle, while also helping to save energy, reduce pollution, and decrease traffic congestion on Gainesville roads, especially during rush hours.

This study is relevant to engineering and education because it covers knowledge of transportation engineering aspects. Specifically, the requirements for safe and sustainable transportation facilities such as a sidewalk for pedestrians, bike lanes, and the need to add streetlights are all imperative for the University of Florida. The paper and results stress that the university needs a multi-model transportation system such as transit, bike riding, and walking in order to get students into a healthier shape and to decrease traffic congestion on the roads. Institutions such as the University of California in Davis show by example that sustainable transportation is very attainable. The University of Florida should take similar steps to promote a feasible and health promoting mode of travel.

597 – Not Presented

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*570 - Enhancing International Recruitment, Teaching, and Research: The Colombia and Malaysia Connection

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EXTENDED ABSTRACT

The Department of Civil and Environmental Engineering (CEE) at Mississippi State University (MSU) is fortunate to have recruited a number of graduate students from Colombia who, in the opinion of members of the CEE faculty, have proven to be among the best! Partially due to the Colombian economy, the competition for admission to Universities is very competitive. In addition, the undergraduate engineering programs in Colombia are longer (160+ hours) than in other countries. As a result the Colombian students are both highly prepared and highly motivated and have been very successful in our graduate programs. Presently, the CEE department has established relationships with several Universities in Colombia and Malaysia with the goals of recruiting students and collaborating in teaching and research. MSU now has memoranda of agreements with three major Colombian Universities - *Universidad Nacional de Colombia, Universidad de Antioquia,* and *Escuela de Ingenieria de Antioquia.* Similarly, we have been working with the Civil Engineering Department, University Teknologi Malaysia (UTM), Johor, Malaysia, over the past several years, collaborating on research, teaching and graduate recruitment. Students there are also highly capable and motivated. Major accomplishments are:

- Recruiting additional Ph.D. and M.S. students.
- Correspondence and meetings (at MSU) with faculty members from other Colombian universities (2008-2010).
- Research collaborations with Colombian universities on studies of the Bogota River during March 2010.
- Teaching International Summer courses in Colombia (2010) and Malaysia (2011).
- Support in the amount of $7,500 from the Office of Graduate School and College of Engineering since 2009 for undergraduate research internships.
- Meeting with faculty and students at UTM, providing program review and serving as a visiting professor during the summers of 2008 and 2011.
- Developing and giving short courses in Malaysia to students from: UTM, Johor; the University Malaya, Kuala Lumpur; Universiti Malaysia Sarawak, Sarawak, and various Malaysian government agencies.

*622 - MoLE-SI: A Mobile Learning Environment for Engineering Education

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Extended Abstract

The availability of new wireless technologies and a variety of mobile computer-based communications devices such as laptops, tablets, netbooks, iPods, and smartphones, among others, makes is possible and appealing for engineering schools to shift from a traditional computer-based instruction, mainly centered on the "fixed computer laboratory," to mobile-based platforms. This shift in paradigm places the computer with the student rather than requiring the student to move to a computer every time a calculation, search or report is needed. In addition, fixed computer laboratory rooms are, in general, not ergonomically fit for efficient collaborative learning environments which should be driving the learning experience in engineering education. Therefore, it appears that an educational environment that is centered on the student-based mobile device is economically feasible, pedagogically efficient, and ergonomically attractive. It is a surprise, therefore, that engineering schools have, at large, not been involved in the development of this type of new educational platform.

In this contribution, we will present a new educational environment centered on the mobile-student device. "Mobile Learning Environment System Infrastructure" (MoLE-SI) is a powerful learning environment based on three key elements: (1) The student-centered mobile device (netbooks, iPod, smartphone; tablets); (2) a new type of classroom that favors the collaborative nature of learning and, (3) remote access servers that perform the CPU intensive calculations needed in many engineering applications. The environment is effectively connected by wireless technology. During the presentation, the authors will describe the results of two pilot studies performed at the Department of Chemical Engineering at Tennessee Technological University (TTU). These will include the description of the different elements used in MoLE-SI, the impact on student critical thinking skills and the overall feedback from students. Suggestions for scaling to a larger unit, such as a school of engineering, will be offered as well.

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613 - Ethical Concerns in Engineering Publications

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EXTENDED ABSTRACT

Most academic tangible rewards are based on a faculty member's or researcher's publication record. The resulting increasing pressure to produce publications earlier and more often in the academic's career exacerbates the problem of a lack of clarity in ethical standards for multi-authored publications. The timing and frequency standards associated with publications for tenure and promotion and continuing research funding opportunities result in academics' maximization of the number of research efforts taken to publication with the number of authors per scientific publication steadily increasing. Further, as the number of authors has increased, the level of contribution of each co-author to the research project and publication decreases. This paper: (1) explores he ethical issues related to publication, authorship, and mentoring with the goal of better defining co-authorship standards as well as encouraging research ethics discussion and education, and (2) examines the current factors affecting the academic research environment and describes some of the unspoken but ethically questionable practices in the academic community.

Keywords: *Ethics, Education, Integrity. Authorship, Mentoring, Publications, Research, Research Misconduct, Responsible Conduct of Research, and Scientific Integrity.*

595 - Survey Practices Implemented In An MDOT Project

Alazar Tsegaye and Tulio Sulbaran

EXTENDED ABSTRACT

Surveys/questionnaires can serve as good sources of information when doing research papers and projects. Some of the common applications of surveys/questionnaires are in problem identification, customer feedback analysis about products/services, and to obtain statistical data. Surveys/questionnaire responses gather from the targeted group provide information regarding the current or past conditions. This information allows the research team to identify existing problems, opportunities and/or facts to evaluate certain hypothesis and or to establish trends and conditions. But in order to gather appropriate vital information the research team has to prepare and include the right questions with defined objectives in the survey/questionnaire.

This paper focuses on the good practices of a success full set of survey/questionnaire as they were implemented in the funded project from MDOT titled "Best Practices of MDOT's Survey Operation, Organization and Technology Implementation." The following are some of the aspects discussed in this report: 1- Clearly define objectives and goals of the survey/questionnaire;2- Know what types of answers or responses we need; 3- Select the time frame by which the survey should be completed; 4- Know how we present the survey/questionnaire and 5- Set the budget for resources we need. In addition to the aspects previously mentioned, a systematic step by step procedure must be used to prepare the survey/questionnaire. These steps include the following: 1- Identifying the target group, 2- Selecting the right survey/questionnaire type; 3- Asking the right questions, and 4-Analyzing the questions and presenting the result: Surveys/questionnaires are meaningless if they are not analyzed correctly. The best analysis is possible for numerical values, for example you can determine the median, average or deviation value. After analyzing the answers, it is important to present the result graphically, because there might be also other parties interested in the result.

614 - Fostering Undergraduate Research through a Student Projects and Research Club

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EXTENDED ABSTRACT

The Auburn University Electrical and Computer Engineering Department founded the Student Projects and Research Club (SPARC) in 2006. Student feedback is presented to confirm that SPARC supports the academic and outreach missions of Auburn University, as well as the program outcomes of the ECE Department. Student responses consistently indicate a sense of engagement and project ownership, and also show how their work on SPARC projects prepares them for both undergraduate and graduate research.

The SPARC vision statement describes SPARC as a "Playground with a Purpose." SPARC is intended to support the academic and outreach missions of Auburn University by providing students with the opportunity to test out their own ideas, integrate concepts learned in class while building devices and computer programs, compete with peers at other schools, and demonstrate their products to the public, including K-12 students. Juniors and seniors who participate in SPARC have the option to earn course credit.

One recurring project that attracts significant involvement is developing a robot to compete in the Student Hardware Competition affiliated with the annual IEEE SoutheastCon meeting. Other projects have included a 6 degree of freedom robot arm, a tourguide robot, a "RepRap" 3-D plastic printer, and a vacuum tube reverb guitar amplifier, to name just a few.

SPARC is funded by donations from alumni and members of our departmental Industrial Advisory Board. Facilities include 450 sq. ft. of lab space, computers, hand tools, small parts, and access to engineering and technical services of the university. Past and present SPARC students come from a variety of majors- Electrical Engineering, Computer Engineering, Wireless Engineering, Mechanical Engineering, Computer Science, and Business. This inherently addresses the ABET requirement for interdisciplinary teaming. There is a significant overlap between the types of projects conducted by SPARC students and the ongoing extramural research in the department. In particular, most of the SPARC projects are related to robotics, so the algorithms developed and the practical experience obtained by students in SPARC produces students who are good undergraduate and graduate researchers in the Cooperative Robotics research lab, as well as others. During several summers, the SPARC lab has been used to host NSF Research Experience for Undergraduates (REU) students working on robotics projects.

SPARC participants report that their understanding of and appreciation for teamwork, lifelong learning, and ethics is significantly strengthened. They report that skills learned in SPARC carry over to their lives and work outside the academic walls, including co-op and full-time employment.

536 - Who Dun It: A Study of MAC Time Update on NTFS

Dae Glendowne, Christopher Ivancic, and David Dampier

The Modified, Accessed, and Created (MAC) times are significant forensic artifacts that can be leveraged by the examiner to help perform event reconstruction of a system. These timestamps tell when the file was created, when the file was last modified, and when the file was last accessed. This information, when combined with other temporal cues, can tell a story about the system itself. While each of these times is important, we consider the last accessed time to be the most interesting due to the manner in which it is updated. We believe it is important that the investigator be aware of how timestamps are updated as well as which user actions and processes in Windows 7 can cause these updates in order to draw more accurate conclusions from the evidence presented.

The MAC times of a file can be updated in a variety of ways by numerous processes, user actions, or malicious tampering. Of these, the last accessed time is the most volatile. Many processes can affect it, sometimes without direct interaction or the realization of a user. As a system is being examined, actions and processes that may have affected timestamps needs to be taken into account.

This paper is a product of ongoing research with the National Forensics Training Center (NFTC). The goal of the NFTC is to provide instruction to law enforcement of modern and relevant forensics technique. To continue providing education and training to the law enforcement we conduct research in techniques and tool development in digital forensics. We believe this work will aid law enforcement in more accurate event reconstruction in the Windows 7 environment.

To test the processes we needed a way to view the process calls in the system. When we performed tasks we had process monitor opened to watch the request packets being passed by the system. We also used the command prompt to check the directory. Clicking on the file to check the times can affect the times of the file but checking from the command prompt does not. Every time an action was performed we check the packets on process monitor along with seeing if the times were updated from the action.

Several processes can affect the timestamps and are performed everyday. We found that copying files would alter the access time of the original files and the new files would have a new created time but the same modify time as the original files. Opening and modifying the content of the file would result in an update to the modify and access time. The time that was harder to track was the access time of the files. For this we would open the files with various programs on most computers and would see if the access time would change. After testing we saw that there was a minimum time of an hour in Windows 7 before a file's access time would be updated and opening the file did cause an update change.

With file sharing be a large part of computer usage we tested to see if timestamps could be updated through file sharing. For this experiment we ran Bit Torrent and shard a folder of pdf files. We discovered that the creation of the .torrent file for the directory did updated the access times of the files, and we discovered that when a second computer uses the .torrent file to download the files, the files had their access time updated.

Anti-virus software runs on computers and is usually scheduled to run periodically. These scans will run and they scan the files on the system. We wanted to see what processes associated with anti-virus scanning could affect the times. We ran tests with various anti-virus software to see if the times were changed. We discovered some AV software did affect the access time while others did not and it depended on what exactly the software was scanning. Create times we found would only be changed when a new file is created. Running normal processes on the files will not change the create times. The modify times will update anytime an action takes place that changes the data within the file. The access times updated every time the modify time updated and would change if a file is opened after at least one hour since the last time update.

We have tested several processes, particularly in the context of the last accessed time, to determine if and how they affect a file's timestamps. We did this by using a combination of manual testing as a user would, scripting events, and win32 API calls in Python, and observing IRPs and fast I/O through Process Monitor. We believe that an access time update will typically occur when a file is read from or written to by a process. There are times however when this is not always the case. For instance, unless the modified time is being updated as well as the last accessed time, such as when you save a file, the last accessed time will not be updated unless the current last accessed time was at least 60 minutes prior.

579 - Digital Forensics Workforce Training for Wounded Warriors

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EXTENDED ABSTRACT

Mississippi State University has a long history of providing digital forensics training to law enforcement through its National Forensics Training Center. Since 2005, the NFTC has trained nearly 5000 law enforcement officers in the tools and techniques used to combat cyber-crimes. This training involves teaching law enforcement officers everything from what not to do on a digital crime scene up to using advanced techniques to perform analysis on digital devices. It has been instrumental in the investigation of hundreds of computer crimes in Mississippi and throughout the U.S. In 2008, the NFTC initiated a project to take this very successful law enforcement training program and transform it into digital forensics training to wounded warriors and veterans to facilitate a possible new career as they transition from the military to the civilian workforce. This training has been provided at approximately 10 different locations throughout the U.S., and it has been very well received. It has resulted in the successful training of nearly 500 wounded warriors in the three+ years of the project. The project continues into 2012 and with anticipated additional funds this year, we hope that we can continue the project into the indefinite future. This hands-on, practical, tactical level training is uniquely suited to wounded warriors. The warriors are learning and discovering that a career in digital forensics may provide them with a future, where the military may not be able to. This gives them the confidence to move forward knowing that they will be able to provide a living for themselves and their families. This effort is good for the country, good for the wounded warriors, and good for Mississippi State University.

594 - Conversion of Information into Process for Collaborative Virtual Reality Environments (CVRE)

Sulbaran, PhD, Mohsen Foroughisabzevar

EXTENDED ABSTRACT

Information is the knowledge that is acquired through experience or study [Dictionary by Farlex 2011]. Information is closely related to the notions of constraint, communication, control, data, form, instruction, knowledge, meaning, mental stimulus, pattern, perception, representation, and especially entropy [Wikipedia 2011a]. In all projects a large quantity of information is generated and in most cases it is not converted into processes. The processes are important because they typically describe actions and routine procedures or steps that support decisions to accomplish actions and/or events. [Wikipedia 2011b].

This report focuses on a case study to convert information into processes for a Collaborative Virtual Reality Environment (CVRE) project done by a student participating in the research team. The student's responsibility was to convert information gathered from the research team members, into processes for the CVRE. In other words, the student documented the steps that other group members conducted in regard to creation of the CVRE.

The process developed by the student had to meet three parameters: 1-clear, 2-simple and 3-detailed. In addition to creation of the process this task was important for the student because the student had to communicate with all team members from different disciplines. This is not a common practices in most universities. Since, most students only communicate in projects with peers in their own disciplines This uncommon interaction with students from other disciplines allowed the student to improve the communication skills dramatically (as demonstrated during the weekly progress meetings) which will help him in future positions. Moreover, the student learned about application of different software in the several fields such as graphic, modeling, and programming. These software include Blender, Sketch-up, Google Chrome, SSH, FTP, Three JS among others.

The processes developed also have broad long term implications, as they will allow users of the CVRE that are not programmers to complete tasks to expand the CVRE capabilities. The users will be able to adjust the CVRE based on their own idea using the processes developed. This simplification will certainty allow users to accomplish tasks that could not be accomplished otherwise and increase their satisfaction regarding the CVRE.

CHAPTER 3 STUDENT POSTER SESSION ABSTRACTS

A-maze-ing Robot

Joshua Deremer and Carl Aquino

Mercer University / Mercer University

EXTENDED ABSTRACT

The purpose of this project is to construct a Lego Mindstorms robot that is able to successfully navigate a maze from start to finish and map its progress. From the information gathered, the robot should be able to follow the quickest route from the end of the maze back to its starting point. The robot will be built using the materials available in the Lego Mindstorms kit. The dimensions of the maze will be 6' x 6'. It will be divided into 1' x 1' cells, creating a 6 x 6 grid. Two mazes will be designed given this standard. Each maze must include one of the seven types of intersections possible. In addition, the mazes should be constructed as perfect mazes, which means that they are composed of only two pieces and contains only one solution.

Several algorithms to solve the maze will be written and programmed into the robot. In addition, the robot will be programmed to document its progress through the maze into its memory. Finally, a third program will be written to understand the documentation program and follow the quickest route back to its starting position.

The robot will be using supersonic sensors to navigate through the maze. It will have a sensor for each cardinal direction besides the rear of the robot. Since the algorithms that will solve the mazes understand that if the robot moves to a different cell, the cell it came from will be empty. Therefore, it eliminates the need for a rear sensor.

In the end, the information gathered by the robot from the documenting program should be presentable. One should be able to retrieve the information from the robot and publish it such that the information is understandable.

Steering Optimization Through Geometric Variation

Kendra Michaelena Atticks
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Background
The Embry-Riddle Aeronautical University Women's Baja team races an off-road vehicle in a competition hosted annually by the Society of Automotive Engineers. Due to time constraints, the team often does not sufficiently evaluate the performance of the Baja car through testing prior to the competition. In particular, the steering and front suspension sub-system has been a challenge for the team to test and optimize. The design of an easily variable steering geometry will allow for more in-depth testing prior to competition.

Purpose
To find a steering geometry that allows for the best steering and handling of the Baja vehicle through analysis of the results obtained during testing.

Design/Method
The location of the pivot point of the tie-rod at the steering knuckle, among other factors, defines the percentage of Ackerman. A piece has been designed to attach to the steering knuckle allowing for the tie-rod pivot point to easily be moved, changing the percentage of Ackerman. The location of the rack and pinion also contributes to the percentage of Ackerman. A frame has been designed that will attach to the rack and pinion allowing simulating the fore/aft movement of the rack and pinion. Combinations of the various rack and pinion and tie-rod pivot point locations will be tested while other vehicle characteristics are controlled.

Results
Quantitative results measuring the turning radius will be collected. Also qualitative results will be included in the analysis based on the driver's perception of the vehicle's handling.

Conclusions
Conclusions and recommendations will be presented at the ASEE-SE conference in April.

Analyzing the hydraulics and sediment transport of a vegetative swale using HEC-RAS

David Bassi, Jairo Diaz

Mississippi State University Department of Civil and Environmental Engineering

Hydraulic Engineering Center's River Analysis System (HEC-RAS) is a hydraulic model that was developed by the U.S. Army Corps of Engineers to execute 1-D hydraulic calculations. The software is made up of four 1-D river analysis tools that all use the same geometric data that is imputed by the user. It calculates steady flow water surface profile computations, unsteady flow simulation, movable boundary sediment transport computations, and water quality analysis. It comprises of a graphical user interface, data storage and management, and reporting functions. The purpose of this research was to use HEC-RAS to assess a vegetative swale by calculating the flows, roughness, sediment loads as well as evaluating a porous check dam located at the end of the swale. The vegetative swale is a Best Management Practice (BMP) that is located on the South Farm at Mississippi State University. The 50-m long swale contains a rip-rap check dam at the downstream end of the BMP followed by a fiberglass flume. The watershed for the BMP contained cattle pastures and is approximately 8.4 ha. Since summer 2011, flows from storm events were measured using a Son-Tec Flow Meter in the field and water levels were used to measure the gage heights during the events. Rating curves (stage vs. discharge) were developed for the upstream, middle, and downstream (flume) sections of the BMP. Thirteen cross sections of the channel were found using a total station and the geometric data was imputed into HEC-RAS. Water samples were also collected during storm events using an automatic water sampler located at the entrance, middle, and flume sections, and the samples were analyzed in the laboratory for total suspended solids as well as various nutrients. Currently, were setting up the model and planning to show model results at the conference.

Biomechanics of Isotonic Exercises

Emily Brett

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EXTENDED ABSTRACT

Cardiovascular training, plyometrics, and weight bearing exercise are all important for building muscle, enhancing athletic performance, and aiding in the process of healthy living. Isotonic exercise, the technical expression for weight lifting, refers to exercise that involves movement throughout a range of motion during which muscle contract and extend, but tension remains constant. The purpose of this project was to analyze muscle activity and to quantify biomechanical forces while performing three basic isotonic exercises: tricep extensions, bicep curls, and leg press.

Three athletically trained females, all varying in height, performed each of the exercises. LoggerPro Video Physics was used for data collection and motion analysis. The joints included in the range of motion were tagged during the experiment, and low intensity, controlled movement was used throughout the exercises to ensure the information captured on camera was consistent. Anatomical geometry was applied in the numeric calculations for determining the forces associated with the exercise motions.

The muscles found to be primarily active during the three observed exercises include the biceps brachii, the triceps brachii, and the quadriceps. By identifying the involved muscle groups and evaluating the biomechanics of these specific exercises, workout training can be further personalized to emphasize muscle strength and to promote joint health in the body of any individual pursuing the benefits of an active lifestyle.

The Anti-microbial Affects of Several Forms of Copper

Erin Brett

Mercer University School of Engineering

EXTENDED ABSTRACT

Copper has been used for centuries as a biocide. The ancient Greeks of 400 BCE recognized the effects of copper to purify drinking water. During the 1800's as U.S. pioneers expanded westward, they placed copper coins in wooden water casks to provide them with safe water during their journey.
Single-dwelling biological sand filters can be an effective and appropriate technology for treating drinking water in developing countries. Current literature suggests that the use of metallic biocides in these filters may reduce pathogen levels below those obtained through biosand filtration alone. A variety of unknowns exists about the use of metallic biocides in the biosand filters. For example, the most effective metallic biocide in this environment has not been identified.

The goal of this project was to test the effectiveness of three copper alloys to disinfect water contaminated with microbial content. The metals to be tested include: Copper (100%), Naval Brass 464 (Cu 60.0%, Zn 39.25%, Sn 0.75%), and Aluminum Bronze 954 (Cu 85%, Al 11%, Fe 4%). Water was collected from the Ocmulgee River. 100 mL aliquots were placed in sterilized containers with a known mass of metal. Critical variables tested included size of metal shaving, coliform concentration, and residence time. The effectiveness of the metals was also tested in the presence and absence of sand.

The knowledge gained from this experiment will be used to help better design biological sand filters during the Mercer on Mission Summer 2012 trip to Kenya.

Determining Accuracy of ModelSmart v1.72 Bridge Modeling Software

Bryan Danley
Mercer University School of Engineering

EXTENDED ABSTRACT

Accurately modeling a structure before construction is a key part of engineering. ModelSmart v1.72 offers the user the ability to model different balsa wood structures and perform load analysis calculations. Computer models are only useful if they accurately predict real-world behaviors of the system/structure. This project compares results obtained from ModelSmart simulations, fail-tested trusses, and hand calculated structural analysis. After modeling and evaluating the structures on ModelSmart, the bridges were analyzed by hand using basic statics concepts. Once simulations and calculations were done, the truss was constructed from 3.175 mm square balsa wood shafts cut to proper sizes and angles and wood glue, and tested to find breaking point. The Warren, Pratt, and Howe trusses were the structures modeled and tested during this experiment. These trusses were selected for the simplicity of building to allow for the most accurate physical rendition of the modeled structure. The testing apparatus consists of two buttresses positioned 25 cm apart with two vertical, clear, acrylic panels on either side of the truss to limit any horizontal deflection of the truss. The load was applied by gradually adding weight to a bucket hung from the truss and was increased until the truss failed. Applied load was measured using a Vernier Wireless Dynamics Sensor System (WDSS) and a video camera was used to capture a record of truss deflection and failure point. The trusses were tested in triplicate. Project results include presentation of predicted and measured failure loads as well as predicted and actual point of truss failure.

Investigating the effects of grain boundary energy anisotropy and second-phase particles on the grain growth of HCP metals

Bradley Jacob Davis and Mohsen Asle Zaeem

Undergraduate Student / Assistant Research Professor

EXTENDED ABSTRACT

In recent years, a drastic effort has been put forth by material scientists to model the complexities associated with the grain boundaries of common alloys. Grain boundaries are highly influential in determining a grain's microstructural anatomy, an anatomy that evolves through various material processing. Predicting and controlling the microstructural evolution of materials during manufacturing processes is vital to material development and structural design, as the grain microstructure determines mechanical and material properties such as Young's modulus, ductility, and hardness. Specifically, high temperature processes lead to a phenomenon known as grain growth by which a number of grains expand in size while others shrink. With heating, grain growth results from excess free energies at the grain boundaries, resulting in a thermodynamically unstable system. To reach a state of equilibrium, grain growth takes place to reduce the total grain boundary area, thus the total grain boundary energy.

Since researchers began investigating the use of computer simulations to characterize grain growth, many advances have been made to understand and predict the grain growth phenomenon of face-centered cubic (FCC) metals. Numerical methods have been utilized such as the sharp interface, Monte Carlo, continuum field, and phase-field methods to characterize grain growth. Previous models have done much to further the knowledge of grain growth, but many of these models did not consider the effects made by the presence of second-phase particles or grain boundary energy anisotropy on the microstructural evolution of hexagonal-close packed (HCP) metals. There are several HCP metals such as magnesium and zirconium which are of great interest to industries. Magnesium appeals to the automotive and aerospace industry because it provides a lightweight, high-strength alternative to commonly used metals steel and aluminum. Replacing steel and aluminum with magnesium eases the ability to create more fuel efficient vehicles. Zirconium alloys are the primary materials for nuclear energy power plants where safety is a main concern when choosing materials.

This work was created to study the effects made by inert second-phase particles and grain boundary energy anisotropy on the microstructure evolution of an HCP crystal system using the phase-field method. The phase-field model was used because it eliminates the need to track interfaces during microstructural evolution, as well as making it possible to include grain boundary energy anisotropy and second-phase particles without enforcing extra complexity to the governing equations of grain growth. The simulations show that not only do second-phase particles reduce or inhibit grain growth, but the effect of grain boundary energy anisotropy also reduces the kinetics of grain growth. The simulations were also compared to previous models where isotropic conditions were explored.

Comparative Modeling of Full-Scale and Small-Scale Biosand Filtration Systems

Edward Davis Lacey IV

Mercer University School of Engineering, Department of Environmental Engineering

EXTENDED ABSTRACT

The goal of this experiment was to model the flow and performance of both full-scale and small-scale biosand filtration systems (BSFs). To test each system, tap water was continuously added to the tops of the filters in such a manner that a constant hydraulic gradient was maintained; steady state conditions ensured that the influent and effluent flow rates of the system were approximately equal. After measuring the hydraulic gradient of each system, a relatively low volume of highly concentrated KCl solution was added to each reservoir. A conductivity probe was used to measure the relationship between conductance of the effluent flows and time elapsed from KCl application. Effluent samples were tested with the probe every three minutes. By the combined applications of Darcy's Law and constructed Conductivity vs. Time plots, the performances of the full-scale and small-scale BSFs were compared. These comparisons will ideally lead to the generation of a general BSF model, which will increase both the accuracy and the efficiency of the laboratory testing related to BSFs. More importantly, by gaining a better understanding of the "black box" process utilized by BSFs, the quality of drinking water for multitudes of people may be improved.

Programming a Particulate Filtration System into Second Life®

Emily Minch and Grey Newell
Mercer University

EXTENDED ABSTRACT

The purpose of this project is to develop a modular, configurable and real-time model of a cyclone in Second Life®. The end user will be able to define the parameters of operation using a control panel in order to explore and characterize the function of a cyclone as it pertains to particulate filtration. The user will be able to visually explore cyclones and their operation by entering design parameters and monitoring operational changes.

Description of Second Life
Second Life® is an online virtual world developed several years ago by Linden Lab. The user generates and customizes an avatar to represent them in this virtual world. Using this custom avatar, the user can fly or teleport to any destination in Second Life. The Second Life® 'world' is user-configurable and programmable. Three-dimensional structures can be built and programmed so that users can interact with them via their avatar. The site of this project is the School of Engineering section on Mercer University's island.

Description of a Cyclone
A cyclone, as it pertains to this project, is an air filtration system that uses vortex separation to remove dust and particles. The dirty air enters the conical body and is spun at a high speed to separate the particulates. The dirt leaves the cyclone at the base of the body and cleaner air exits from the top. Cyclone design specifications are based on ratios of body height, influent opening height/width, diameter of exit, length of vortex, length of body, length of cone, and diameter of dust outlet to the body diameter. Therefore, the user only needs to enter the body diameter and the other dimensions will be adjusted based on the design ratio specifications. Users will also be able to input the mass flow rate to the system and size composition of the influent particulate stream.

Engineering Disciplines Used
This project incorporates both the computer and the environmental disciplines. The physical model of the cyclone was built using a 3-D modeling package embedded in the package of tools available in Second Life®. Knowledge of programming was needed to develop the cyclone and control panel to correctly perform the desired design and operation calculations. This project also incorporated the environmental discipline in that the group needed to become familiar with particulate filtration and how cyclones are used, designed, and operated.

Large Eddy Simulation of Channel and Jet Flows

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EXTENDED ABSTRACT

Turbulent flows are present in engineering applications. The objective of this research is to visualize turbulent flow fields to enhance understanding of the turbulent flows beyond the mathematical equation covered in the fluid mechanics class. To achieve the overall objectives Large Eddy Simulations are performed for channel and jet flows using a pseudo-spectral solver with dynamic Smagorinsky turbulence model.

Computational Fluid Dynamics Process and Numerical Methods
A general computational fluid dynamics process involves following aspects Geometry → Physics → Grid → Solution methods → Flow Analysis. The user defined parameters used in this study are: Reynolds number (3×10^4 and 1.3×10^4 for channel and jet flows, respectively); boundary conditions (periodic in streamwise and spanwise directions, and walls and zero-gradient in the normal direction for channel and jet flows, respectively); turbulence model which is dynamic Smagorinsky model; Grid sizes consisting of 400K, 1.3M and 4.8M points; number of processors; and solution iterations. The simulations are performed using a parallel pseudo-spectral solver, which uses Fast Fourier Transform in the spanwise and streamwise direction, Chebyshev polynomials in the normal direction, and MPI and OpenMP for parallelization.

Turbulent Flow Analysis
The flow analysis process involves visualization of: Diagnostic → 3D Solutions → 2D Spatially Averaged Solutions → Spatially and temporally averaged solutions. This study uses Tecplot for flow visualization. The diagnostic files, such as turbulent kinetic energy or wall shear stress (for channel) help track the flow development from the initial conditions to the fully developed turbulent simulations, and guide the solution iteration requirements. The visualization of the 3D volume solutions shows a random turbulent nature of the velocities and the small scale vortices in the flow. The 3D solutions show some organized structures such as the ejection events and hair-pin vortices near the wall for channel flows, and Kelvin-Helmholtz type instability for jet flows. The 2D spatially averaged solutions help assess the organized structures underneath the "random" turbulence. The analysis is performed for streamwise velocity mean (1^{st} order), root-mean-square (RMS) of velocity fluctuations (2^{nd} order statistics); skewness (3^{rd} order statistics) and flatness (4^{th} order statistics). The results show that the turbulence has well defined turbulent characteristics, such as: high RMS near the channel wall or inside the jet; higher skewness and flatness near the channel wall or jet edge and almost uniform values elsewhere. The spatially and temporally averaged solutions are compared with available direct numerical simulation results to validate the LES predictions. Further analysis is underway to explain the nature of the second and higher order statistics of the turbulent fluctuation, including evaluation of the effect of grid resolution on the turbulent flow predictions.

Design and Creation of a Temperature and Moisture Controlled Three-Dimensional Tracheobronchial Lung-Airway

Kristin Marko, Mario do Nascimento, and Jamie Oakley
Advisor: Sinjae Hyun, PhD.
Mercer University

EXTENDED ABSTRACT

Inhalers and nebulizers are usually used in treatments for asthma and other chronic respiratory system disorders. They are used to deliver medication directly to the patient's lungs, which offers less side effects and more direct treatment compared to oral medications. Several different models for inhalers and nebulizers are available; however, all rely on the airflow dynamics of the lung airways in order to deliver the medication to the appropriate location in the lungs. Accurate dosage prediction may lead to better patient care.

Due to the lack of *in-vitro* aerosol particle deposition studies in a temperature and humidity controlled lung airway model, a senior design team at Mercer University was formed. This team consists of three biomedical engineers, Kristin Marko, Mario do Nascimento, and Jamie Oakley. Kristin Marko was responsible for the computational aspect due to previous experiences in this field. Mario do Nascimento used his programming and electrical background to program and interface the electrical components, while Jamie Oakley was responsible for casting of airway models and data collection.

Preliminary research yielded a three-dimensional (3D) model of the subject-specific airways which was imported to ANSYS CFX to test computational fluid dynamics and thermal energy (i.e., temperature) distribution. The research concluded that there is significant temperature (approximately 13°) difference between the mouth and the exits of the tracheobronchial airways based on different mass flow rates of inhalation. It was also determined that more rapid breathing, as in the case of an asthma attack, causes less of a temperature change through the airway system. The two aspects of this design project include the creation of a humidity controlled 3D tracheobronchial airway environment and the construction of a temperature controlled environment for the model. The airway was created using polyurethane foam cast around a three dimensional subject-specific upper respiratory model of a healthy male. The model was housed in a Plexiglas box, whose temperature and humidity were monitored using a microcontroller, temperature sensors and a Relative Humidity Sensor.

The temperature and moisture controlled airway models were built and will be tested using a mono-dispersed inhalation aerosol delivery system. Experimental results, such as aerosol delivery and deposition in the airway, will be compared to computational results.

Bench Scale Gray Water Treatment System

Mark Harris, Alex Perry and Andrew Swinford

Mercer University- Environmental Engineering

EXTENDED ABSTRACT

The purpose of this design project was to model the treatment of gray water using four different treatment systems. Gray water is wastewater generated from domestic activities such as laundry, dishwashing and bathing, which has the potential to be reused on-site for irrigation and/or toilet flushing. The goal of the study was to determine the operational characteristics of a gray water treatment system.

The bench scale model that was used had several components. Influent was held in a chilled 25-L container. Chilling was accomplished by partially submerging the container in an ice bath. A mechanical stirrer was used to keep solids in suspension. Influent was pumped from this tank to the treatment system using a bilge pump. The treatment system can be used to model up to four unique processes. Primary treatment is applied in one of two 10-L vessels. This treatment is followed by secondary treatment in one of four 4-L vessels. All vessels are covered to prevent algal growth. Effluent from the 4-L vessels discharges into beakers for sample collection and flow analysis. Residence time of the system is an important design parameter and was evaluated via a tracer study. This was done by using a feed solution with a known concentration of P-nitrophenol and then monitoring the flow rates and P-nitrophenol concentrations throughout the system. The concentrations measured were compared to mass-balance predictions.

Four different treatment techniques were modeling in a 2-week study of the system. The treatment techniques modeled were detention time, detention time with UV-C radiation, detention time with aeration and detention time with aeration and UV-C radiation. The aeration treatment trains use microbial growth to treat the gray water while the detention treatment trains rely primarily on settling for treatment. The UV system works by using special arc lamps that sterilize bacteria and prevent them from reproducing. The effectiveness of these treatment processes was analyzed by performing 5-day biochemical oxygen demand, chemical oxygen demand, total solids and suspended solids tests. Through comparison of the experimental results, the effectiveness of each treatment process can be determined.

Key findings of this study include the effect that UV-C radiation has on disinfecting the gray water. In both the un-aerated and aerated trains, the treatment with radiation showed the largest reduction in bacterial levels. Results also suggest that the composition of the gray water, low substrate concentration, does not support the aerobic growth of microorganisms that would normally be used to treat wastewater.

Assessment of Soil Characteristics of a Biofiltration Swale System in South Farm, Mississippi State University

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EXTENDED ABSTRACT

The United States Environmental Protection Agency (EPA) prescribes regulations for residual storm water quality in farms to reduce impacts on the environment. Best Management Practice (BMP) is a series of techniques including activities, processes, treatments and structures that are applied to a unit of land for treating storm water discharges. The EPA agency determines acceptable levels of storm water quality in different states. Approximately 39% of the nation's rivers and streams are impaired, meaning they do not meet basic water quality standards. In Mississippi, more than 500 water bodies were listed as impaired by the Mississippi Department of Environmental Quality (MDEQ), many of which are located in farm areas. In 2007 a selected swale in Mississippi State South Farm was fenced and seeded with buttonbush for assessing best management practices in cattle areas. Several studies have determined the effectiveness of vegetated swales in improving water quality. This research will continue understanding the relations between environmental parameters and a BMP biofiltration swale system, including soil texture, particle analysis and water retention capacity. Soil texture, particle analysis and permeability are determined using the standard USDA (U.S. Department of Agriculture), and the water retention will be determined using the Soil Water Retention Curve (SWRC). This research aims to understand the relationship between the physical properties of the watershed and BMP soils, and the water quality characteristics at the outlet of the biofiltration swale-system (BMP). This understanding is necessary in order to assess the effectiveness of the BMP system, and also necessary to improve the design and future installation of more BMP structures in South Farm.

Arterial Pulse Velocity Instrument

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EXTENDED ABSTRACT

The propagation velocity of the pressure wave created by the arterial pulse is known as the pulse wave velocity, or PWV. The PWV can be measured non-invasively on a continuous beat-to-beat basis using a variety of methods that detect the pulse at two consecutive locations and use the resulting transit time and travel distance to calculate the pulse wave velocity. Current research shows that the PWV correlates to a variety of important health indicators, including a direct correlation to a patient's blood pressure. In addition, a pulse wave velocity instrument can be constructed to be both portable and accessible to the average home user.

The goal of the project was to design, build, and test a prototype instrument that measures and displays the PWV in blood traveling between the brachial and radial arteries. The measurements had to be taken continuously on a beat-to-beat basis and displayed to the user every fifteen seconds with a precision of 100 mm/s and an accuracy of +/- 5%. The device was required to be as small and as light as possible to maximize portability. The instrument was also required to be safe, reliable, and easy to use.

In order to achieve this goal, the design was split into three major components: transducer, signal processing, and storage media portions. The final transducer design uses two infrared emitting diodes and a phototransistor for its high emitter power coupled with a balanced power consumption, cost, and spectral efficiency. The final processing design is a digital comparator design that leverages the advantages of software to minimize the amount of hardware needed. The design uses a PIC microcontroller to pole both the brachial and radial signals for a pulse and measure the time between the two pulses. The selected storage media design uses an FTDI chip that automatically allows any personal computer to read EEPROM using a standard USB port. The FTDI design takes advantage of the widespread accessibility of USB and the simplicity of EEPROM. The prototype was constructed on printed circuit boards and placed in a small portable and arm-mounted processing case along with two transducer bands. The final cost for constructing the design was $108.11.

Modular testing was used to make sure each piece of the design was operational. Tests included validating that the signal and filter spectrums were aligned and that the resulting analog and digital signals contained the PPG information. These tests were carried out using oscilloscope testing, fast Fourier transforms, and digital-to-analog verification of the digital signal. The power and memory storage media were also tested, verifying that the voltage and current outputs were within specifications and that the processor could successfully store information on the EEPROM in a USB-accessible fashion. Finally, system-wide testing was conducted to ensure that the device was integrated successfully and that reported measurements met the accuracy and precision requirements.

Studies in Friction Stir Welding

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[1]Undergraduate Research / [2]Graduate Advisor

EXTENDED ABSTRACT

Friction Stir Welding (FSW) is a solid state joining process of welding that involves the movement of material using a rotating bit that plasticizes the parent material without ever melting the material. This process preserves more of the mechanical properties as well as the microstructure of the parent material than other forms of fusion welding such as electric arc welding and additive welding. As FSW becomes more commonplace in industry, the technicalities of what is happening to the material being welded and what advantages and disadvantages FSW holds become of more interest for researchers. With a focus on defects generated by FSW, this project discusses data collection methods and possible links between collected data and defect formation in FSWed aluminum specimen. The goal of this project is to understand what happens in the FSW process that causes defects and to come up with new methods on ways to study the samples to collect data in a way that is nondestructive to the material.

The team consists of four undergraduate research members and one graduate student research advisor. The graduate student does most of the analysis while the undergraduates collect a majority of the data. However, ideas for improving testing and data collecting techniques are shared among everyone.

The results of the project have given the team an idea of one of the major factors in FSW defects: shoulder contact of the tool. Without good shoulder contact, the weld is bound to have defects. Also, one of the most effective techniques for studying the defects of FSW has been to study the microstructures of the samples along with hardness testing.

Measurement of Migratory Forces Acting on Abdominal Aortic Endovascular Stent Grafts

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Mercer University

EXTENDED ABSTRACT

Abdominal aortic aneurysms (AAA) are one of the leading causes of death in America, especially among men above the age of 60. One of the forms of treatment for AAA involves the insertion of an endovascular stent graft into the aneurysm, blocking the flow of blood. In patient follow up studies, it has been reported that the endovascular stent grafts have a tendency to migrate causing a rupture of the AAA and the complication due to the AAA migration may potentially result in death. In order to determine the forces acting on the endovascular stent grafts, results from theoretical models, computational modeling and analyses, and experimental measurements were compared.

The models that were used in testing the apparatus were designed using the ANSYS Design Modeler software. The abdominal aorta has a wide variety of geometries including branches such as renal, celiac, and mesenteric arteries and a bifurcation at the end of the aorta into the iliac arteries. These varieties appear in the angle between the iliac artery branches, the location of the aneurysm in relation to the bifurcation, and the neck angle of AAA. The geometric variations to be tested were determined by taking the average values from the range of conditions found in literature for the patients with abdominal aortic aneurysms. The computational hemodynamics modeling and simulation program (ANSYS CFX) was also used to determine the forces acting on the endovascular stent grafts. The maximum force that acts on the examined AAA model geometries was found to be approximately 9.5 N. These findings were supported by numerical analysis calculations performed using the Reynolds Transport Theorem (RTT), with a percentage error between the models of no more than 2.5% at the greatest. These forces were then used as evaluation parameters for the components of the experimental apparatus.

The experimental testing will be performed under biological conditions. The Reynold's number for the system at the inlet was calculated to be 5300 (range of 5000-6000). The pressure and flow rates will be monitored and adjusted to maintain a biologically accurate system (90-110 mm Hg pressure range at the inlet of the model and a flow rate range 4.0-4.5 x 10^-4 m^3/s). This parameters will be tested at varying conditions to account for the differences between genders, health, and age among patients. The forces that are acting on the stentgrafts due to the fluid force will be measured according to the displacement of the model during steady state flow conditions. Sliding linear potentiometers will be used for measuring this displacement. The change in resistance is directly correlated with the displacement, and from the displacement values the force can be determined. The migratory forces will be measured for all the cases tested in CFD and with numerical analyses. Obtained results will be compared between all three data sets to determine the accuracy of the modeling and any issues with the experimental apparatus.

Second Life® Activated Sludge Aeration Basin

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EXTENDED ABSTRACT

Purpose

This project seeks to explore the possibilities of virtual world computer programs as engineering teaching tools. The incorporation of virtual world teaching tools into curriculums will allow students access to real world engineering applications that they otherwise could not see.

Engineering Concepts

Second Life® is an online virtual world with built in three-dimensional modeling software and Linden Scripting Language, a programing language developed specifically for Second Life®. With these tools, Second Life® allows its users complete creative freedom as well as allowing the user to retain the copyright for their creations. Second Life® is relatively unexplored as an engineering teaching tool with endless possibilities and can potentially replace physical field trips with virtual ones, thus reducing travel time, costs, liability, and logistics.

Wastewater treatment plants are responsible for removing containments from wastewater to produce environmentally friendly fluid and solid waste products. An activated sludge aeration basin is a major part of this process. These basins are a microbial culture of bacteria and other micro-organisms that are responsible for assimilating the organic matter in wastewater. These cultures metabolize the organic material to carbon dioxide, ammonia as well as cellular material.

Significance

This project focuses around the modeling of a steady-state activated sludge aeration basin in Second Life® to be incorporated as a teaching tool for Environmental Engineering courses. Eventually, a virtual, fully-functional wastewater treatment plant is going to be constructed around the aeration basin. Ultimately, this project seeks to use virtual world teaching tools in engineering courses to expand students learning experience.

The Use of Ozonation to Improve the Treatability of Pulp and Paper Mill Effluent

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EXTENDED ABSTRACT

The goal of this project is to investigate the efficacy of using ozone in conjunction with an existing wastewater treatment scheme to improve the discharge quality of Graphic Packaging, International's (GPI) wastewater. GPI is a pulp and paper mill plant and its wastewater effluent contains organic compounds, including tannins and lignins. Due to the chemical composition of these compounds, they are often non-responsive to typical wastewater treatment. It is believed that ozone can help convert the lignins and tannins from a recalcitrant pollutant into organics that are more readily utilized by the bacteria in the aeration basin of activated sludge treatment. The effluent from GPI is treated at the Rocky Creek Wastewater Treatment Plant located in Macon, Georgia. The current treatment method at the Rocky Creek facility is extended-aeration activated sludge, which incorporates aeration basins at the influent. Ozone (O_3) and activated sludge are two very different techniques for treating wastewater, that when used in tandem can produce a high-quality effluent. Ozone treatment is an effective disinfectant and can be used in conjunction with other treatment techniques.

A 10-L clear PVC, semi-batch, bubble column was used to supply ozone to the wastewater during the bench-scale study. Ozone was supplied from an Ozotech ozone generator at a rate of 1.7985 mg O_3 min^{-1} for 20 minutes. To ensure that the contents of the bubble column were completely-mixed, a continuous recycle stream (290 ml min^{-1}) was provided using a peristaltic pump. A 4.725 L vessel served as the aeration chamber. One pump equipped with 2 diffusers was used to ensure adequate dissolved oxygen concentrations.

Analysis on the wastewater include pH, temperature, turbidity, color, soluble chemical oxygen demand, a five-day biochemical oxygen demand, oxygen uptake rate, solids volume index, absorbance and solids. These tests were conducted before and after ozonation and post aeration. Results from before and after treatment were compared. A control experiment was conducted to determine color and COD removal on the industrial wastewater treated in the bench-scale aeration basin only; no ozone was applied to the wastewater used for the control. Preliminary results show that ozonation decreases the COD and color of the industrial wastewater. Experiments also show improved settleability of the wastewater samples as well as a significant decrease in COD, color and absorbance.

Drag Force Analysis of Tractor-Trailer Aerodynamics

Matthew Yin

EXTENDED ABSTRACT

An essential part of today's economy is the transportation of goods across the country. One of the major methods of shipping goods between locations has been through semi trucks and the iconic trailers they tow behind them. Although the price for the resources fueling these tractor trailers has risen, the demand for goods transportation has not. Prices across the economy as a whole have risen as the expenses for delivering shipments have increased.

Although these tractor trailers are fast ways of shipping large shipments, the fuel that takes to run them is very costly. In order to help find ways to minimize fuel cost and maximize fuel usage, experimentation will be done to test how different design parts added on to tractor trailers could reduce drag and thereby improve fuel economy.

Simple models of a tractor trailer will be developed through the use of Google SketchUp 3-D modeling. Physical models will be printed with3-D printers. Models will be tested in a wind tunnel where slip stream smoke will be used to help visualize how air flow affects the model. A Vernier Wireless Dynamics Sensor System (WDSS) will be used to calculate drag force. In order to determine the effect speed will have on drag force, measurements will be taken at varying wind speeds. All tests will be performed on a tractor, tractor-trailer, tractor-trailer with a cab cover, a tractor-trailer with a rear aerodynamic cone, a tractor trailer with trailer underbelly covers, and a tractor trailer with all aerodynamic components attached. Experimental results should indicate which aerodynamic components provide the largest reduction in drag force and associated increase in fuel economy.

Aerosol Deposition Study of Subject-specific Upper Respiratory Model

DoHyun Daniel Yoon and Anthony Fratino
Advisor: Sinjae Hyun, PhD.

Mercer University

EXTENDED ABSTRACT

Inhaled aerosol deposition studies with an accurate model of the human respiratory system allow health professionals to gain insight into the interactions between particulate matter and the exposed surfaces of the lung airways. Pharmaceutical companies and pulmonologists find these studies useful in evaluating the efficacy of inhaled medicinal aerosols and devising new patient treatment regimens. The purpose of this study was to investigate inhaled micron size particle deposition within a subject-specific 3D model of the oral cavity, pharynx, and trachea.

Image processing software, ScanIP (SimpleWare, UK), was applied to process two-dimensional computed tomography (CT) images and to reconstruct a subject-specific 3D model of the upper respiratory system including oral cavity, pharynx, and trachea. The reconstructed 3D model was printed out of ABS plastic and then used for the experimental measurement of regional aerosol deposition. The Oleic acid droplets with florescent (i.e., liquid droplets) were generated by a vibrating orifice aerosol generator (TSI Inc) which fed into a steady air flow. These droplets then passed through a Kr-85 charge neutralizer before the delivery to the model. The airflow rates through the upper respiratory system were 25, 40, and 57 LPM. Particles that passed through the model were collected on a 47 mm diameter Millipore filter with 1.0 μm pore size. Each section of the model was dipped into deionized water for several seconds to dissolve deposited florescent. This process was repeated 4 to 5 times to ensure the complete removal of droplets deposited in the region. The florescent in the washed solution was measured with a Flurometer (Model 110, Turner Associates). Regional aerosol deposition was calculated by regional florescent deposition concentration.

The aerosol deposition in the oral cavity was higher than the aerosol deposition in the oropharynx region, the middle section of the 90 degree bend of the upper respiratory system. Oropharynx deposition was lower than the laryngopharynx and oral cavity depositions. Variation of flow rate reduced deposition in the oral cavity and oropharynx when the flow rate was increased from 25 to 40 LPM. However, higher deposition was measured at 57 LPM. Statistically only the laryngopharynx deposition trend shows increasing deposition as flow rate increases. Total DF, deposition fraction, for each flow rate corresponds to 4.94% at 25 LPM, 4.38% at 40 LPM, and 9.48% at 57 LPM.