

ie

Department of Industrial Engineering

Virtual Collaboration

This fall, Clemson researchers — Drs. Melloy, Leonard, Gramopadhye and Greenstein from industrial engineering and Dr. Andrew Duchowski from computer science — will move VR from the lab to the classroom where it will be used to teach aircraft maintenance technicians. They are collaborating with Carey Castle, director of the Aircraft Maintenance Technology Program at Greenville Tech, in an effort funded by the NSF. The initiative reflects a model partnership between a university, a two-year college and industry.

The multiyear project looks at cutting-edge ways to use advanced technology to improve human performance in aircraft inspection. Various aspects of the project have been funded by different federal agencies:

- \$1 million from NASA
- \$655,000 from the FAA
- \$1.1 million from the NSF

Promoting Safer Skies

Imagine being able to train technicians using an interactive simulation of their actual working environment. Now take this idea one step further, and consider its implications in a critical area such as aircraft inspection. Leading a multidisciplinary effort, Dr.

Anand Gramopadhye is conducting research to do just that.

“Using high-fidelity VR simulations, we can realistically mimic a wide-bodied aircraft hangar environment in the laboratory and can actually place the trainee in this situation,” says Dr. Gramopadhye.

With this technology, various scenarios typical of the real hangar floor are created to see how trainees react. Their performance is then evaluated to detect defects and provide training for improving performance. Researchers can run controlled studies in the laboratory and test the effectiveness of interventions that could lead to improvements in performance.

The environment’s state-of-the-art technology tracks the trainee’s eye movement, allowing scan paths to be monitored. This information can be given as feedback to the trainee. Researchers are also



Clemson’s Virtual Reality Laboratory



Eye movements of a trainee inspector in a VR environment

“At Clemson we have always conducted research, but now we are finding ways to apply this to actually impact aviation safety.”

developing and validating mathematical models that will allow them to predict inspector performance accurately.

“At Clemson we have always conducted research, but now we are finding ways to apply this to actually impact aviation safety,” says Dr. Gramopadhye.

This innovative work has developed simulators ranging from computer-based training systems to high-fidelity immersive VR environments that will ultimately yield tangible improvements in aviation safety.

Message from the Department Chair

From the outset, let me introduce myself. I am the incoming chair of the Department of Industrial Engineering, a position held previously under Dr. Michael Leonard's excellent stewardship. During my 12 years at Clemson, I have thoroughly enjoyed my interactions with alumni, students, faculty and staff. The Clemson spirit of seeking excellence in education, research and service is exemplified in the work done by the alumni and by the activities of the IE department. Through this newsletter, we will share with you some of the more recent happenings and plans for the future of its program.

Beginning with the 2003 academic year, our department has embarked on the ambitious undertaking of becoming one of the elite IE programs in the country. We are developing a roadmap that dovetails with Clemson's vision of becoming a top-20 public university by 2010.

The department will focus its efforts in the information technology-driven emphasis areas of production and service systems, human factors and ergonomics, and education and learning systems. We will build on our considerable strengths in each of these areas by developing new courses, increasing research funding from industry and federal sponsors, hiring faculty and conducting more extensive outreach activities.

As part of this plan, we have reorganized our education and research activities under the auspices of six laboratories: Advanced Quality Engineering Laboratory (AQEL), Advanced Technology Systems Laboratory (ATSL), Education and Learning Systems Research Laboratory (ELSRL), Ergonomics Laboratory (EL), Human-Computer Systems Laboratory (HCSL) and Supply Chain Engineering and Optimization Laboratory (SCEOL). This issue of the newsletter features the SCEOL. You can learn more about all of the labs on the departmental Web site. We encourage our alumni to develop closer ties with these laboratories and make use of this resource.

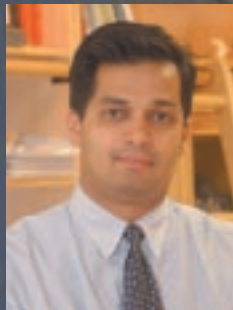
As part of a University-wide initiative on curriculum renewal, we are evaluating our program to ensure that it provides a state-of-the-art IE education that meets the needs of industry and our external constituents. Our record speaks for itself: We continue to have one of the highest enrollments per faculty on campus. We have the highest doctoral graduation rate per faculty on campus. Our students continue to be highly sought by industry. And in the last two years, we have graduated 11 doctoral students, five of whom secured faculty positions.

Yet we still face significant challenges in improving the quality and quantity of research and laboratory space. Such challenges present new opportunities. Many of the new initiatives can be achieved only through the generous support of our alumni and friends. We truly appreciate your contributions to the IE department over the years, and I hope you will continue to give at whatever level you can so that we can grow from strength.

As a parting note, I encourage you to visit our Web site at www.ces.clemson.edu/ie — and if you happen to be in the Clemson area, please drop by the department to meet us.



Dr. Anand Gramopadhye



Focus on Faculty



Prized Professor

Associate Professor of Industrial Engineering Brian J. Melloy received the 2003 Douglas W. Bradbury Award in recognition for his outstanding work with Clemson's Calhoun Honors College.

Dr. Melloy is one of industrial engineering's most energetic, enthusiastic and dedicated faculty members. He has served as Honors College coordinator for the department since 1997. In that time, Dr. Melloy has redefined the senior departmental honors program, recruited and mentored honors students, and facilitated the transition from an all-course-work senior honors experience to a thesis-research one.

In addition to these duties, he is the coordinator for the department's undergraduate program and academic adviser for incoming honors students. Dr. Melloy also teaches a junior seminar for senior departmental honors students each semester.

A noted authority on the use of virtual-reality technology in aircraft inspection training, Dr. Melloy routinely involves undergraduates in his research, including students sponsored by the NSF Research Experiences for Undergraduates Program. In this capacity, he advised the Clemson team that won second place in the IIE Simulation Contest, a prestigious national competition for IE undergraduates. His students have also developed a visual inspection simulator that continues to be used as an experimental tool by other IE undergraduate and graduate students.

Established by a gift from the Class of 1940 in honor of classmate Douglas Wilson Bradbury, the Bradbury award includes a plaque and a \$1,000 professional development allowance. Dr. Melloy was also recognized with the Byars Prize for Excellence in Engineering Science Education in 1999.

Strengthening Supply Chains

Supply chain optimization is a powerful business strategy. Integrated control over the processes that convert raw materials into finished goods and distribute them to customers can create a dramatic, positive impact on quality, cycle time, product customization and cost. But knowing that this potential exists and knowing how to realize it in a particular environment are two entirely different issues. That's where Clemson's Supply Chain Engineering and Optimization Laboratory (SCEOL) steps in.

SCEOL provides a place for students and faculty to conduct theoretical and applied research focused on optimizing the dramatic impact of supply chain management. Projects typically use engineering analysis and design along with computationally efficiency optimization models to address a wide range of problems related to forecasting, inventory control, scheduling, distribution and quality engineering.

A few of SCEOL's recent investigations include the following:

- A decision-support tool designed to assist shop schedulers in selecting employee tasks that will have the greatest profit potential
- Government-funded research on multi-objective scheduling and cooperatively holding inventory — issues fundamental to next-generation supply chain logistics systems
- An industry-funded project that developed a strategy linking materials requirement planning (MRP) output into a spreadsheet-based optimization scheme to provide the person responsible for placing orders with a way to dramatically reduce inventory but maintain service levels

The goal of SCEOL is to solve real problems with rigorous approaches that employ user-friendly interfaces for consistent and correct implementation. The result is that clients are provided value-added solutions to important problems, graduate students receive an outstanding research and educational opportunity, and the research activities in SCEOL remain closely tied to relevant problems.

For more information on SCEOL, please contact Dr. Bill Ferrell (864-656-2724, fwillia@ces.clemson.edu) or Dr. Mary Beth Kurz (864-656-4652, mkurz@clemson.edu).

Focus on Alumni

Melroy D'Souza MS '93, PhD '96 IE *Microsoft Corp.*



As design and usability manager for exchange server products at Microsoft, Melroy D'Souza leads a team responsible for all domestic and international user research, usability activities and design of exchange server products. D'Souza is also in charge of creating and executing strategies to ensure that Microsoft products address the needs of customers, integrate seamlessly into customer environments and provide business value. To ensure success of these activities, he works closely with various functional groups at Microsoft and participates in many customer- and user-related activities. Melroy stays active in the IE profession by attending conferences and writing articles and papers. Prior to his position at Microsoft, he worked as the principal human factors engineer of the enterprise division at Gateway Computers.

Carl Klebe BS '72 ME, MS'95 IE *Klebe Consultancy*



In his role as an independent consultant, Carl Klebe offers clients a wealth of experience in the design, manufacture, sales and distribution of consumer electro-mechanical products for management and engineering.

During his 40-year career, Klebe has worked on everything from application of plastics to replace metals as structural components in consumer products to integrating engineering documentation with manufacturing planning and execution systems. Under his leadership, a multinational team developed new products and manufacturing processes.

Klebe focuses on supply chain and lean manufacturing, and he looks for opportunities to translate lessons in manufacturing to service segments of the economy. Engineering projects include major purchases of automation, injection molding, motor winding and CNC machining equipment as well as the implementation of major IT systems.

Klebe's Clemson IE connections remain strong. He is currently serving his 12th year as a member of Clemson's Industrial Engineering Industry Advisory Board, and his granddaughter is a Clemson freshman who plans to major in IE.

Seeking Nominations

Clemson's Department of Industrial Engineering introduces the annual IE Alumni Award, which will recognize alumni who have had a notable impact on the IE profession. The recipient will be invited to the department's Honors and Awards Banquet in April to accept the award. **The nomination deadline is February 2, 2004.** Please take the time to nominate a worthy candidate by going online to www.ces.clemson.edu/ie/people/alumni.htm.



New Departmental Web Site

The department has launched a new Web site at www.ces.clemson.edu/ie.

Research Poster Competition

The Department of Industrial Engineering held its first Research Poster Day October 10, 2003. The industrial engineering advisory board reviewed the posters for presentation and quality of research. Funda Samanlioglu and Sarat Tangudu were awarded first place for their poster. It was based on their research work, "Random Keys Genetic Algorithm for a Symmetric Multi-Objective Traveling Salesman Problem." Kunal Kapoor, Nikhil Iyengar and Pallavi Dharwada were awarded second place for their entry, which focused on "Development of an Industry Standardized Auditing and Surveillance Tool." Uday P. Haral received honorable mention for his poster, which was based on his thesis work, "Random Keys Genetic Algorithms Applied to Multiobjectives Scheduling Problem Considering Traditional and Non-Traditional Objectives." The next department poster competition will be held this spring.



Better Computing Facilities

Last summer, Room 111B in Freeman Hall was converted from a instructional computer lab into a general use computer and studying room. Students from IE 201 provided a basic design that was adapted by Drs. Kimbler and Kurz.

Changes included wireless Internet access, laptop support, scanner, installation of a high-speed duplex-capable printer, several tables, chairs and a couch to facilitate group work, and improvement in lighting.

"111B is a great place to come and study between classes," says Sara Ballentine, one of the students who contributed to the project. "There is always someone in here working on the same thing you are, in case you have questions or need help. This lab is a positive and helpful addition to Freeman Hall."



IIE Cookout

As part of a student fund-raising effort, the IIE Student Chapter held a cookout on September 29, 2003, in front of Freeman Hall.

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