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Spring 2001

The Chair's Corner
by Dr. Tsu Wei-Chou
You may recall that in the Winter 2000 M.E. News, I mentioned the preparation for a strategic planning meeting by the faculty. I pleased to inform you that the meeting was held during the Winter Session earlier this year, and there was an intensive exchange of ideas among the faculty and a critical examination of our vision and goals for the future of the department. Now I would like to update you on some of our recent activities in undergraduate education, graduate education, and alumni relations.

Undergraduate Education
This has been a very active year for the undergraduate curriculum. In the Spring, we are graduating the first class of the M.E. 2000 program—which included our first two seniors. In the Fall, we merged the ASME dinner meeting with the Winter 2000 session earlier this year, and there was a more active discussion about the future of the department and the steps we need to take to improve undergraduate education.

Improving undergraduate education. The honors day celebration at the University this year was on May 4. We are very proud of the fact that over 130 students, or 14 percent of the student body in the College of Engineering, are recipients of honors day awards. Engineering students make up about 8 percent of the undergraduate population, yet they received 25 percent of the honors day awards of the University. Our senior, Jennifer Buckley, who is active in varsity athletics and a 4.0 student, received the W. Francis Lindell Award for the Distinugished Senior. Alex Kelly, who will have enough credits upon receiving his BME degree to also be awarded a Master of Engineering degree, received the W. Francis Lindell Award as well as the Mary and George Nenoski Award for Excellence in Undergraduate Research.

However, we are not sitting still! Based on inputs from freshman advisement and on analyses of the student body in the College of Engineering, we've made some adjustments to the Math/Calculus sequence—making five of the six undergraduate programs in the College identical in their calculus sequence. Another major effort will involve our continued accreditation efforts as well as the new ABET criteria. Though we aren't scheduled for review until 2005, we're piloting a more comprehensive evaluation/assessment program that will involve inputs from current students, industry (employers of our graduates), and—of course—alumni!

I am also pleased to announce that Professor Dick Wilkins has been appointed by the Dean as the Associate Dean of Engineering College for ABET for an additional five-year term. We are very fortunate to have his capable and dedicated service to all engineering departments in this important task.

Graduate Education
We have continued to improve our graduate program over the past few years. During the past two years, we saw an increase in the quality and the incoming graduate students. We attribute this to a higher admission standard as well as high-quality and diverse research programs led by the faculty of M.E. Engineering. We are committed to continue our effort in improving diversity of our graduate student body.

Our new Graduate Curriculum is intended to educate students with broad knowledge in traditional and emerging areas of mechanical engineering. The degree program also integrates the students in carrying out their dissertation research at a very early stage of study. With the expansion of the department research in up and coming areas like biomedical engineering and nanotechnology, our student's increasing exposure to and trained in interdisciplinary and cutting-edge research.

We also would like to share with you a complete effort being made by the faculty and administration in graduate recruitment, which is vital to the success of our graduate program. I would like to express my appreciation to our students to the research activities of the department, Professor Suresh Advani has organized a PowerPoint presentation that highlights the research programs in the department. This presentation is on the W. Francis Lindell Award is also available, so we will be able to faculty members for recruitment activities during their travel. Several faculty members visited local universities and made recruitment presentations this semester to expose the students to the research activities in the department, and to motivate good students to apply to D. Elawe. Also, a new initiative known as SURE (Summer Undergraduate Personal Research Experience in Mechanical Engineering) has been initiated to give undergraduate students from other universities to spend a summer at D. Elawe. Our plan is to continue to present seminars at four-year colleges and universities in the immediate area to get greater interest in graduate studies. We will also be requesting help from our alumni in recruiting new students to our department.

I am pleased to mention that our grad student, Jingbo Wang, is this year's winner of the Linda F. Fellowship for $18,000. The Linda F. Fellowship is given not only in recognition of outstanding scholarship, but also as a token of appreciation for an individual who also has a variety of interests and talents. Jingbo received his undergraduate degree in mechanical engineering from Tsinghua University in China, and is pursuing a Ph.D. degree.

Student Viewpoint: Interview with Senior G. Paul Ledebur
By Diane Kuchich
Recent years may have witnessed a downward trend in M.E. enrollment, but there doesn't seem to be a lack of jobs for M.E. graduates—at least not if you ask Paul Ledebur ('01 BME). Ledebur, who has accepted a position with W. L. Gore & Associates as a process engineer, was named as one of the 20 best and brightest engineering students at the University of Delaware. Ledebur says, "You have to be good at problem solving. It's a skill, and it's something that I think is very important in the workforce today. You have to be able to think critically and analyze problems. You also have to be able to work well in teams and to communicate effectively."

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Student Relations
Finally, I again urge you to continue to be an active member of the department's alumni community. Please keep us apprised of your own activities—see Alumni Association Section or log on to http://www.udel.edu/alumni/ and click Alumni Association. We are also asking you to participate in the ABET criteria. Though we aren't scheduled for review until 2005, we're piloting a more comprehensive evaluation/assessment program that will involve inputs from current students, industry (employers of our graduates), and—of course—alumni!

I would particularly appreciate your thoughts and feedback on these issues. I will work closely with the faculty in the coming months for resource development, which will be devoted to undergraduate education, research, undergraduate teaching laboratory facilities, and scholarship for domestic graduate students.

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Early Introduction to Design Principles. But will it go straight?

While they may not represent the cutting edge of automobile technology, mousetrap cars provide more than enough challenges for the student creators, who must design a vehicle to travel as far as possible on spring power. In early December, 18 teams, composed primarily of freshman mechanical engineering students, brought their creations to the Pearson Hall gymnasium for the M E E G 101 (Introduction to Mechanical Engineering) Competition and Mousetrap Car Contest.

Not only were they required to build a mousetrap-powered device, but students also had to predict how far the vehicles would travel each time the device was engaged.

Prof. Dick Wilkins said that while professors provide the mousetraps, students must build the cars, which cannot exceed 12 inches in any dimension and must provide a receptacle to hold a soda can positioned vertically. “The wheels are actually CD’s,” Wilkins said. “The soda cans are partially filled with sand, and the amount is varied with each heat or race.”

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Spring Follow-up Projects

After completion of Senior Design in the fall, two student teams chose to continue working with their industrial sponsors in the spring to further develop their prototype solutions. Both Harley-Davidson of York, Pa., and Case-Neholland, Case-PolySeal, Xymid, and Zenith Corp. Representatives from these companies kept the nine student teams focused on their project goals and helped the students learn design process subtleties, including value-based tradeoffs, timely communications, and contingency planning.

The M E E G 401 Senior Design 2000 was put on hold between the fall and spring semesters. Since the fall was project-driven, this spring’s effort required students to continue working on their design projects. But it was pretty intense!”

The “Fall 2000” session of Senior Design was successfully concluded in December. This was the inaugural for a single semester format—still six credits, but in half the time. M E E G 401 students thought that the pace was very intense, but when the dust settled, the Senior Design Staff Team (Dick Wilkins, Mike Keefe, Jim Glancy, and Nate Cloud) felt very good about the effort that the student teams had put forth.

Any improvements are in the planning stages to make this key student learning experience even better in Fall 2001. These include streamlining the integration of teaching/learning the design process with the production of tangible results for industrial sponsors of the projects. Upgrades in resources that support the student teams in their efforts to rapidly convert their ideas to reality (i.e., proof-of-concept prototypes) are also being planned.

The cars, with ticket prices coming in at under $5, must be self-contained and travel at least one meter. The real challenge for the students is being able to predict accurately how far each unit will travel with changing payloads. After the performance trials, the distance traveled by each car gets recorded on a data collection sheet, and a complicated formula determines the M P I, or Mousetrap Performance Index, with the top 10 teams qualifying for further rounds until an eventual winner emerges.

While this group of freshman M E students was putting their distance estimating skills to the test, students in M E E G 403 Senior Design 2000 were putting the finishing touches on design presentations for the six-credit course required for all mechanical engineering seniors.

These final presentations, held Friday, December 8, in the Composites Center Presentation Room, represented the final stage in a course designed to give mechanical engineering students the freedom to pursue general and technical electives during the spring semester of their senior year.

The course includes the development of system designs, benchmark test practices and the design, fabrication, assembly, and testing of improved prototypes.

This year all the design processes were industrially sponsored, and the semester-long time frame is comparable with industry practices in the real workplace,” Wilkins said. “This has been an excellent learning experience for the teams.”

The class permitted seniors to show their expertise with such projects as a shower rod sleeve assembly, a “high viscosity” car modification, a roll gap adjustment system, child-resistant bottle caps, and a complicated industry testing system, handling placement system.

This was the first year that two groups of mechanical engineering students gave final presentations so close to each other,” Wilkins said. “By doing so, it gives people a chance to see what students are doing at the beginning of their academic careers and how they finish up.”

Try it yourself; or with a son or daughter who might be interested in engineering as a career! Just build a device for less than $5.00 that will fit within a 1 ft. cube; powered by a common mousetrap that can carry a payload (e.g.; soda can - your choice) at least 1 meter on a hard surface. The rest is up to you! W inner is minimum M P I. Best student scores were around M P I = 1.0 ....actually one team got zero which caused the professor to re-think the algorithm for next year—a good lesson in course design!
Tom Buchanan, Associate Professor of Mechanical Engineering

Dr. Thomas S. Buchanan is eager to define the field of biomechanics to those who are interested but aren't aware of the many dimensions of this relatively new area of mechanical engineering and the issues associated with it. An accomplished teacher and researcher, Buchanan is Director of the Biomechanics & Movement Science Program (BMSP) and is Director of the Biomechanics & Movement Science Program (BMSP) and the Center for Biomedical Engineering Research (CBER). As a professor, Buchanan explains the difference in roles that mechanical engineering and biology, and other areas of medical science are interested in new ways to provide care. Buchanan’s research involves how we use our bodies and lead to improvements in how we care for them. Buchanan finds an eager audience in one who has practiced mechanical engineering for about 40 years, but who is feeling the consequences of overly aggressive use of the old body in recent years—I only hope that the commercial application of Tom’s work will be accelerated.

A New Cable Robot

by Dr. Sunil Agrawal

The robotics group has recently fabricated a new cable robot for research aimed at long-reach manipulation tasks to impact automation in shipyards and airplane hangars. In their initial design, the work space requirements are three to four orders of magnitude larger than what is typically given by conventional systems or parallel robots. This research is currently being performed in cooperation with the National Institute of Standards and Technology (NIST). The robot was designed and fabricated by a group of students working in the Mechanical Systems Laboratory, consisting of a six degrees-of-freedom cable robot mounted on a two degrees-of-freedom gantry. A photograph of this experimental facility, along with details of the cable robot and its control system, is shown in the figure. The robot has three concentric guide rails 120 degrees apart with a moving shuttle on each guide rail. When a shuttle is turned in such a direction, each shuttle can slide radially. Through each shuttle, two ropes are connected to a triangular end-effector plate. Each arm of the triangular end-effector plate has two ropes connected to it. Six direct-drive servomotors, each driven with encoders, drive the six cables. The data acquisition and control system of the system is through a DSP-1103 board with MTLAB Simulink and Real-time Workshop as the front-end interface. This robot was designed and built by a student group that includes Jason Pusey, Abdulhassan Alloz, Gregory Pease, and Stephen Pidgeon, under the supervision of Prof. Sunil Agrawal and Prof. Dan Santare. H andrew Pota from Australia.

Dr. Michael D. Greenberg, Professor, recently had a book published, Differential Equations and Linear Algebra, by Prentice Hall. This book provides a new foundation for the study of linear algebra and differential equations, making it accessible to students with a variety of backgrounds.

Dr. Suresh G. Advani, Professor, and Dr. Michael H. Santare, Associate Professor, filed a patent for a novel design of a shock absorber. The analysis shows that this implant causes less stress shielding and has the potential to last longer in younger patients. This book “Simulations for Control of Liquid Composite Molding Processes” was selected as the TOP (The Outstanding Paper) at the Society of Manufacturing Engineers conference last year.

Professor Santare was awarded a Distinguished Fulbright fellowship to lecture and conduct research at the University of Firenze in Italy. While on sabbatical from U.D., he is spending the spring term there collaborating with engineers and scientists on several projects involving fracture of nonhomogeneous materials and orthopedic biomachanics.

Dr. Lian-Ping Wang, assistant professor, was awarded the 5th Annual Excellence in Research Award. Anthony S. Wexler, recently published two papers in the journal of Fluid Mechanic on the modeling of particle coagulation in turbulent flow; other significant publications include a paper in the International Journal of Multiphase Flow and another in a recent AIAA meeting, with graduate student Mr. James DeSpirito, on simulation and modeling of multiphase flow in rotating turbomachinery.

Dr. Michael J. Keefe, Professor, is working on a project with Dr. Ping Zhang from C Department Chairperson, to investigate the mechanical response of the seams used in the Air Force Research Laboratory cooperative control of unmanned vehicle systems.
When Nancy Sottos, 86B M E, and her colleagues at the University of Illinois-Urbana Champaign submitted an article on their innovative polymer research to Nature, they weren't thinking about mainstream publicity or future commercialization. Their goal was simply to publish their work. However, the day before the Feb. 15 publication of Nature, the story of the "self-healing polymers" developed by the UI research team made the front page of The Washington Post.

Within days, press coverage had expanded to include more than 75 print, radio and television media, including The Associated Press, The New York Times, National Public Radio, MSNBC, The BBC and The Discovery Channel in Toronto. Sottos was getting calls from relatives who had heard her on the radio in Singapore and from students whose parents had spotted her on their local cable TV affiliates.

The materials that are getting so much attention are composites that can repair themselves when they crack or break. In this particular application of the self-repair concept, the materials are made up of a healing agent encased in a pill-type form along with a catalyst, all embedded in the matrix of a structural composite. When the material cracks, the microcapsule ruptures and releases the healing agent, which then comes into contact with the catalyst, initiating polymerization and formation of a bond to seal over the crack. In this way, microcapsules can be fixed before they turn into structural-threatening macrocracks.

According to Scott White, professor of aeronautical and astronautical engineering at UI and head of the research team that developed these novel materials, "Once cracks have formed within materials, 'healing' can begin only when a crack interrupts the healing agent, which then comes into contact with the catalyst, initiating polymerization and formation of a bond to seal over the crack. In this way, microcapsules can be fixed before they turn into structural-threatening macrocracks."

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In his review, Wool mentions potential applications of the work, including remote space stations, prosthetic organs, and bridges. Sottos acknowledges that commercialization is feasible, but it's obvious that's not where her focus lies. She's waiting for the commotion to die down so she can get back to her research and her teaching. For additional information, checkout Nancy's website: <http://ssm7.aae.uiuc.edu/self-healing/>
Upcoming Activities - Homecoming

Homecoming this year is October 13th. The Alumni Association & Faculty are planning a special event for ME alumni that will include a gathering for fellowship and lunch. There is a limited supply of free tickets to the homecoming football game with Hofstra (tickets will be in an ME block). Please let me know by returning the feedback section below if you think you would like to join us for this event so that we can do some advanced planning. We will be providing more details later.

E-mail Campaign

Most of you should have received a postcard from us asking you to return the card with your e-mail address. We also decided to supplement this with a phone call campaign. Undergraduates have been making the calls and we hope this hasn’t been too much of an intrusion in your busy days! Our goal has been to build an interactive community of alumni of the Mechanical Engineering Department. When we started in early April, the ME alumni data base had about 250 e-mail addresses out of about 2500 active alumni; and 50 alumni had signed up on our alumni web site (http://www.me.udel.edu/alumni/index.msql). To date, over 500 email addresses are logged into our database, and over 100 alumni have signed up on the web site. Just one of the possibilities in the future is to be able to send a version of this newsletter directly to you via e-mail, as other Universities are doing. We will be exploring other ways of using this capability for mutual benefit, while endeavoring to avoid the “downside” aspects of e-mail - intrusiveness and information overload. We welcome your ideas on maximizing the value of this capability. If you haven't done so already, please add your e-mail address to the feedback section below.

Number of UDME Alumni in our world continues to grow but is the downward enrollment trend reversing?

The graphic shown below is just one of the results of our recent efforts to better understand the demographics of our Mechanical Engineering Alumni community. The good news is that the number of active UD mechanical engineering alumni continue to grow—surpassing the 2,500 mark! In the process of looking over the alumni database it did, however, become apparent that there has been a downward trend in the graduate class size since the mid-eighties. A brief search for some overall trends indicates that a downward trend has occurred for all engineering enrollment (about 20% in 15 years according to the American Association of Engineering Societies). AAES (http://www.aaes.org/) also presents data that indicates that mechanical has been the most popular engineering discipline based on the number of 1999 bachelors degrees (~13,000 ME's vs. 2nd place, ~12,000 EE's). The overall downward trend in engineering enrollment appears to be reversing in the past few years, however. In addition to the AAES data, Mechanical Engineering magazine (http://www.memagazine.org/), reports in a September 1999 editorial by John G. Falcioni that, “ME and engineering enrollment was trending upward.”

We haven’t researched this deeply enough to understand fully what has caused the downturn since the 80s, but we would be very interested in your views on the subject—especially what you think will contribute to an upward direction at Delaware. We also found it interesting to look back over the years and try to understand the reason for changes in the numbers of alumni in various class years. Some of the more senior folks on the faculty have suggested that some of the larger class sizes were due to Government programs following international conflicts—for example, the “GI bill” following WWII. What do you think about these trends? Please return the feedback section with your thoughts.

ALUMNI FEEDBACK - What’s New With You?

Do you have any feedback (comments, questions)? Or let us know any current events or info not covered by the data sheet below.

IN FORMATIO N FOR THE DEPARTMENT’S RECORDS

Name ___________________________________________ Middle ___________________________ Last ___________________________

Delaware BME Date ___________________________ MME Date ___________________________ Ph.D. Date ___________________________

Spouse’s Name __________________________________ DE Alum? ___________________________

Mailing Address ___________________________ E-mail ___________________________

Home Phone ___________________________ Company ___________________________

E-mail ___________________________ Mailing Address ___________________________

Business Phone ___________________________ Fax ___________________________

E-mail ___________________________ Web Address ___________________________

Please identify if your company is an affiliate or subsidiary of a larger company ___________________________

Return this form to: Nate Cloud, 126 Spencer Lab, University of Delaware, Newark DE 19716 and/or contact me anytime at cloud@me.udel.edu or 302-778-4567

Graph from American Association of Engineering Sciences (AAES) - http://www.aaes.org
The College of Engineering's rich academic tradition of excellence has been nurtured throughout its 90-year history by people who believed that the past and present are an integral part of the future. Now, one of the most important events in the history of the College is taking place: the College is working to reach a $45-million goal within the University's $225-million Campaign for Delaware. With the help of our alumni, we had nearly $30 million or 65 percent of our goal by the end of February, but we need your help.

The College's campaign steering committee recently held its third meeting. Representatives of the Mechanical Engineering Department serving the committee include Nate Cloud (64) and Jim Laser (69). Our dedicated volunteers invest hours of personal time, energy, and expertise in addition to their financial resources, and we are grateful for their participation. Currently, we have one open seat for another ME representative.

If you would be interested in serving on this committee, please contact us. And please consider joining our team in support of the college and the Department of Mechanical Engineering. Though you may never be aware of the impact you have on another's life, gifts of cash, appreciated securities, real estate, life insurance, annuities, trusts, and bequests all assist in the intellectual growth of our students. Simply put, your partnership in our common purpose will provide U.D. students with a better engineering education.

The future of the ME department begins with you. No gift is too small. In addition to the influence your gifts have on our students, your gifts also influence our national rankings and alumni satisfaction surveys. On behalf of the college, I thank you for your consideration and, again, ask for your support.

SENIOR YEAR AWARDS
W. Francis Lindell Mechanical Engineering Award to the Distinguished Senior
J. Buckley
A. Kelly
Mary and George Nowinski Award for Excellence in Undergraduate Research
A. Kelly
Delaware Section of the American Society of Mechanical Engineers Senior Design Project
1st place (tie): D. Cook, M. Dunson, J. Gordon, A. Yiournas
Team 9 = J. Buckley, M. Hawley, C. Laboy, A. Martin
2nd place: A. Cox, M. Petrova, D. Richard, W. Vilda

JUNIOR YEAR AWARDS
W. Francis Lindell Mechanical Engineering Award to the Distinguished Junior
S. Campbell
W. Francis Lindell Mechanical Engineering Achievement Award
M. O'Leary
Cordant Technologies Scholarship
D. Cintavey

SOPHOMORE YEAR AWARDS
W. J. Renton Award for Outstanding Sophomore
D. Ferney

OTHER DEPARTMENT AWARDS
Delaware Section of The American Society of Mechanical Engineers Outstanding Student
F. Li
American Society of Mechanical Engineers Student Section
A. Kobets
Robert T. Bosworth Scholarship
J. Rochester
Redden Scholarship
J. Feser

COLLEGE AWARDS
Bangalore T. Lakshman
A. Barkley
Conectiv Power and Light Scholarship
T. Shipman
Liston Houston Scholarship
D. Das
Panel of Distinguished Seniors
J. Buckley
RISE Corporate Friends Award
A. Barkley
George W. Laird Merit Fellowship
Jingbo Wang

Honors Day Awards

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