UNIVERSITY OF DELAWARE

mechanical engineering NEWS

Spring 1999

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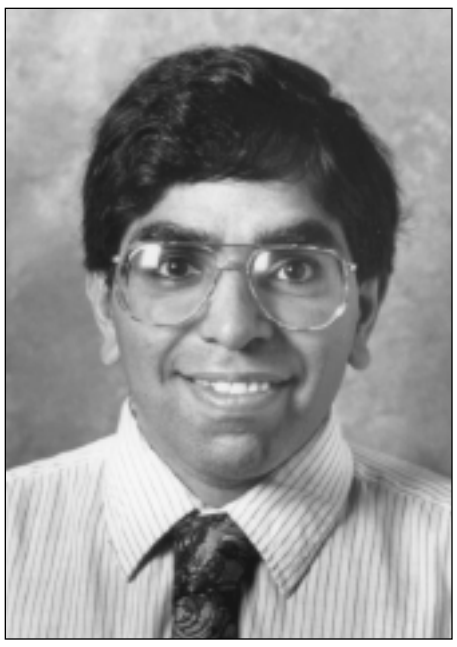
The Chair's Corner

by Dr. Suresh G Advani



The past six months have been about change. As many of you know, our chair, Andras Szeri, was invited by the Provost to serve as Interim Dean of the College of Engineering after Stuart Cooper accepted a position at the Illinois Institute of Technology in September 1998. Andras then asked me to "keep his chair warm" for this year.

Following the retirement of Prof. John Meakin at the end of the year, a search was initiated to hire an assistant professor in manufacturing, biomechanics, or controls to strengthen these areas of our research. For those of you who remember senior design, we are going to introduce a new emphasis on industrial relevance. The goal is to have fully funded senior design projects from local industries. To help us with this, we have hired alumnus Nate Cloud as a part-time senior design consultant. Nate, one of our basketball stars, graduated from Delaware in 1963 with a BME and earned a master's degree in 1972. He has worked for the DuPont Company for 35 years. Another new resource for this program is our recent acquisition of a 3-D printing machine (http://www.zcorp.com) to make the CAD dreams of our students come true.

Other news is that two of our young professors (Hai Wang and John Lambros) have won early career awards from NSF. This is a great honor, as only 5 percent of professors achieve this honor. Dr. Vinson and Dr. Chou were also recognized by the American Society for Composites when they received service and research awards, respectively.

I have always wanted to hold a Nowinski Symposium to celebrate Professor Nowinski's contributions to our department and to the field of engineering mechanics. I am very pleased to report that this is about to happen, appropriately enough, on May 14, 1999, his 94th birthday. World-class mechanics researchers have agreed to give a day of seminars in his honor. Each one of you is invited. The agenda is available at our Web site or by calling the Department office (302-831-2421).

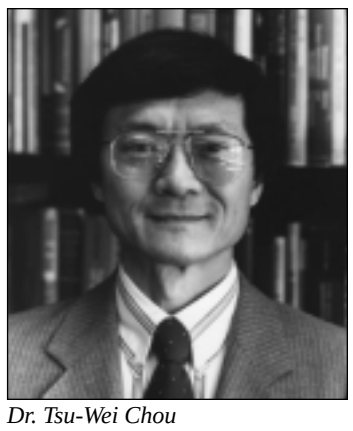
New grants initiated this year were Phase II of the Advanced Materials Intelligent Processing Center (AMIPC), with Karl Steiner and myself as the Principal Investigators. This $2.5-million program will bring automation into composites manufacturing using sensors and simulations. The industrial partners in the program are Boeing and Honeywell.

Another major research grant was awarded to Dr. Buchanan by NIH. The goal of this $1-million project is to develop a detailed understanding of the effect of anterior cruciate ligament (ACL) injury on knee movement.

The University's Capital Campaign is underway to raise funds for buildings, equipment, endowed chairs, and fellowships. Any of these gifts can be targeted by the donor to a particular department. The primary goal of the ME department has been to increase both the quality and the quantity of our graduates at all skill levels. Endowed professorships will allow us to attract the best faculty and expand our programs in emerging technologies for the new millennium. Graduate fellowships and undergraduate scholarships would significantly help our students to achieve their degree goals.

Named Professor Recognized as New Engineer Fellow

(reprinted with permission from University of Delaware *UpDate*)



Dr. Tsu-Wei Chou

Tsu-Wei Chou, Jerzy L. Nowinski Professor, has been elected a fellow of the American Society of Mechanical Engineers (ASME).

In recognizing his accomplishments, ASME cited his research in the application of analytical techniques to the study of a broad range of materials problems. These include the use of the concept of physical defects to understand the deformation behavior of metallic, biological, and geological systems; analytical modeling of the microstructure/performance relationship of fiber-reinforced polymeric composites; and processing science and damage mechanics studies of metal- and ceramic-based composites.

Chou joins two other UD faculty members who are ASME fellows: Andras Szeri, Interim Dean of the College of Engineering, and Jack Vinson, H. Fletcher Brown Professor of Mechanical Engineering. With a doctorate from Stanford University, Chou has been on the UD faculty since 1969 and was a founding member of the Center for Composite Materials. He received the ASME Charles Russ Richards Memorial Award in 1996 and the Distinguished Research Award of the American Society for Composites this year. Chou has served as a visiting professor at several institutions in Europe, South Africa, South America, and Asia. He is an honorary research professor of the Beijing University of Aeronautics and Astronautics as well as Northwestern Polytechnic University of China. The author and editor of several books in materials science and fiber composites, Chou is the North American editor of *Composites Science and Technology.*

Senior Design Project Earns Additional Honors

Senior Design is now history to the winners of last year's design competition, but their invention continues to make news. Dina Berlingieri, Harminder Parmar, Shawn Riley, and Stephanie Simpson, all 98BME, designed and constructed a Metal Foam Injection System for the Fraunhofer Center-Delaware that has the potential to expand the applications for lightweight metal foams. Prior production techniques limited part geometry to sheets or simple profiles, but the UD injection gun enables molten metal to be injected into complex molds, with the foaming action taking place inside the mold cavity.

Almost a year after completion of the project, Berlingieri informed Professor Dick Wilkins, Senior Design advisor, that "on a whim," she had submitted the project to a design contest sponsored by *Design News* magazine. It was selected as the third place winner for "Exellence in Design" and written up in the March 1, 1999, issue of the magazine (http://www.manufacturing.net.magazine/dn/webex/search.html).

"Quite honestly, I didn't realize then the impact your senior design class would have on my career," Berlingieri, now Commodity Manager with Hewlett Packard in Wilmington, Del., wrote to Wilkins. "I learned so much, not just in design, but in giving presentations and managing projects, that I apply on a daily basis."

"In addition, Dr. Yu of the Fraunhofer Resource Center has informed us that he has since applied for a patent on our system. Without senior design, we would have never been given the opportunity to have been a significant part of such an exciting project."

The winning team in the mechanical engineering senior design competition are shown with their metal foam injection gun, developed for Fraunhofer Resource Center. From left, (standing) are Dina Berlingieri and Stephanie Simpson and (kneeling) Shawn Riley and Harminder Parmar.
Photo by Gwynn Lyell

ME Department Reaches Out

by Kathy Werrell, Assistant Dean

Through the College's Engineering Outreach Program, the Department of Mechanical Engineering reaches out to alumni, part-time graduate students (both near and far), and the K-12 community. For example, Paul Franco (95BME), who accepted a position with DuPont immediately after graduation, was transferred to West Virginia. Early in 1996, Paul began taking ME courses on video, so that by the time he was transferred back to Newark in 1997, he had already completed six of the ten courses he needed for his MME degree. This spring, he will join the growing numbers of Outreach students who have earned their master's degrees on a part-time basis. Congratulations, Paul!

The reason Paul and others have been successful in completing UD ME courses without coming to campus is the excellent support provided by faculty who have videotaped their courses. In addition to courses taped by Professors Chou, Santare, and Szeri, those offered on video by Professors Greenberg and Vinson are particularly attractive to Outreach students. Over the past five years, Professor Greenberg's engineering mathematics courses have been viewed remotely by more than 100 students, many working in industry while they take courses toward a graduate engineering degree. Meanwhile, Professor Vinson has produced a series of three video courses in composite materials that have been taken by nearly 40 distance students.

Engineering professionals not seeking college credit find their needs met by intense non-credit short courses offered through Engineering Outreach. A new series in maintenance engineering was kicked off this spring, with ME adjunct faculty Dr. William Fagerstrom as one of the instructors. ME outreach goes beyond graduate education. Each summer, math, science, and technology teachers from Delaware's high schools hear fascinating presentations by ME faculty and then bring those engineering concepts back to their classrooms. Some teachers have subsequently brought their students to campus for special presentations.

For more information about Engineering Outreach, contact Kathy Werrell (302-831-4863) and watch the web (www.udel.edu/engg/DeptsPrgms/EO/)

Class Notes

Robert C. Wetherhold, 76MME 84PhDME, of Amherst, N.Y., associate professor of mechanical and aerospace engineering at the State University of New York at Buffalo, spent the past academic year as a Fulbright Senior Scholar at the Institute fur Verbundwerkstoffe in (IVW) Kaiserslautern, Germany.

Geoffrey A. Bidlack, 77BME, of Norcross, Ga., is supervisor of engineering at NTN Bearing Corp. of America.

Thomas J. Frey, 84BME 90MME, of Wilmington, Del., an engineer at Thiokol in Elkton, Md., was awarded two patents for rocket motor designs.

Michael Vari, 86BME 95MME, of Newark, Del., earned formal registration as a professional engineer in the state of Delaware in June 1998. He is currently contributing to fuel cell technology.

Thomas J. Bockius, 90BME, of Pittsburgh, Pa., received a master's degree in industrial administration from Carnegie Mellon University.

Gina-Marie Jacobs Regan, 92BME, of Washington, N.J., an environmental engineer for Paulus, Sokolowski & Sartor in Warren, N.J., is pursuing a master's degree in environmental engineering at the New Jersey Institute of Technology.

DOUBLE DELS
Jim Crittenden, 75BME, is plant manager at Coors Ceramics, and **Ann Olewnik Crittenden**, 76AS, is a physician and director of the Newborn Intensive Care Nursery at St. Mary's Hospital. The couple lives in Grand Junction, Colo. They have one daughter, Laura.

MARRIAGES
Holly Leager, 97HNS, to **Neil R. Smith**, 98BME, January 17, 1998.

NEW ADDITIONS
Olivia Jane, born May 13, 1998, to **Holly Leager**, 97HNS, and **Neil R. Smith**, 98BME.

Paul Ray, born March 9, 1998, to **Rosalind Young**, 80BME, and **James Mattox**.

DEATHS
Joseph W. Higgins, 51BME, of Seaford, Del., June 24, 1998

Richard N. Sunderland Jr., 40BME, of Keystone, Fla., June 29, 1998

George M. Rossiter, 47BME, of Keene, N.H., July 12, 1998

ME Alumni Group

by Art Holveck, 55BME

Are you interested in getting closer to the Mechanical Engineering Department–in finding out what is happening, what the students are doing these days, and what the current "hot buttons" are at the University?

At the invitation of Dr. Andras Szeri, former Department Chairman and now Interim Dean of the College of Engineering, some of us met to discuss how this might happen in ways that meet the needs of the Department as well as the interests of the alumni. An alumni group from many classes met initially in September to determine whether there was interest in continuing to explore how this might happen. Subsequent meetings have led to a preliminary organization whose aim is to determine how an interested alumni group could become more actively involved with the ME Department.

The leader of the group, selected by acclamation at the last meeting is George Sestak '72. Other members are Art Holveck '55, Nate Cloud '64, Alton Smith '66, Bob Shoemaker '71, Jennifer Watt Matherly '79, Mark Hopkins '80, Ken Grier '88, and Jerome Posatko '97. The group has been very capably assisted by Professor Anthony Wexler.

So far, a Web page has been created to allow easy connection with alumni through the Internet. Beyond that, we are working to define just how this relationship might work out. The current direction seems to be toward alumni involvement in

- Delaware Days and National Engineering Week
- Recruitment efforts akin to UD's VAST program
- Career guidance and student mentoring
- Research funding using industry and government contacts
- ASME and classroom assistance on how mechanical engineering is done in the real world

Other items being considered are planning social events around Homecoming and other University activities and providing a mechanism for assistance in alumni job hunting.

More information will be forthcoming, so look for it in this newsletter and in other University publications. If you are interested in participating with the ME Alumni group, check in on the Web page at and fill out the information requested there on the sign-up form, or contact Tony Wexler by phone 302-831-2421, fax 302-831-3619, or email wexler@me.udel.edu

Robert R. Davis Named Alumni, Development V.P.

(adapted with permission from University of Delaware *UpDate*)

Robert R. Davis, UD Assistant Vice President for Alumni and University Relations since 1997, has been named vice president for development and alumni relations. In this position, he will assume a leadership role in the $225-million Campaign for Delaware, the first comprehensive capital campaign in the institution's 255-year history.

Provost Mel Schiavelli called Davis ideally suited for the position because of his long relationship with the Alumni Association. "He can be expected to build on that experience and develop many new friends for the University of Delaware," Schiavelli said. "The deans and I look forward to working closely with him on advancement issues in the academic program."

Davis, who holds two bachelor's degrees from UD and a master's degree in education administration from Bowling Green University, has been a UD employee since 1977. He previously was dean of students and director of public information at Wilmington College. At UD, Davis has served in a number of capacities in the alumni relations office and the development office, including director of research and records during the University's 150th anniversary capital campaign, which supported an addition to Morris Library as well as scholarships.

He was director of University relations in the Office of the President for nine years before becoming director of the combined offices of alumni and University relations in 1993. The combined office has responsibility for alumni activities and major academic ceremonies.

ME Alum Featured in National Magazine

Mohsen Shahinpoor

The Bionic Woman and the Six Million Dollar Man may have been the stuff of 1970s TV fantasy, but plastic muscles, silicon senses, and limbs powered by miniature motors are evolving from fiction to reality in the 1990s. Mohsen Shahinpoor, 70PhDME, is contributing to this "blurring of the line between man and machine" with his work on ionic polymer metal composites (IPMCs) and ionic polymer conductor composites (IPCCs), materials that respond to electricity with elasticity and responsiveness similar to those exhibited by human muscles. Director of the Artificial Muscle Research Institute (AMRI) at the University of New Mexico and Regents Professor in the UNM School of Engineering and School of Medicine, Shahinpoor was recently featured in a *Popular Mechanics* article entitled "The New Bionic Man" (February 1999).

Shahinpoor and his research group are the creators of Myster Bony, a replica of a human skeleton that pedals, albeit very slowly, an exercise bike in a lab at AMRI. Myster Bony moves the pedals with battery-powered artificial muscles made of IPMCs and IPCCs, composites that can bend and flap when an electric current is supplied. Conversely, when strips of these materials are bent, voltage is produced, effecting an appropriate level of force and motion. The complementary capabilities of moving and providing feedback like an intelligent sensor are what drives the skeleton on his bike and offers the potential of increased mobility for patients with disabilities.

While Myster Bony is powered by electrically controlled muscles, Shahinpoor and his colleagues are developing another type of artificial muscle that is also chemically controlled. The process involves baking synthetic fibers and boiling them in a chemical solution, a treatment that confers both strength and elasticity which varies in the presence of an electric current. The resulting materials mimic living tissue in their ability to expand and contract.

For now, the electrical currents that stimulate these muscles are artificially supplied by an external source. "Our vision," says Shahinpoor, "is to develop an artificial muscle that could take its commands from electrical impulses supplied by the human nervous system."

While that goal will probably not be realized in this century, Shahinpoor envisions a number of applications for these "smart" materials, ranging from swimming robotic structures and wing-flapping flying machines, to slithering snakes, heart and circulation assist devices, and peristaltic pumps.

As a doctoral candidate at Delaware, Shahinpoor was advised by Professor Jerzy L. Nowinski, a world-renowned expert in the field of engineering mechanics. A lecture series honoring Nowinski's service and his extensive contribution to the field was initiated in 1975. Since then 24 distinguished speakers have delivered Nowinski Lectures, including Shahinpoor in 1988. This year, the Nowinski Symposium will be held to celebrate the lifetime contributions of Prof. Nowinski on May 14, 1999, his 94th birthday. A group of international experts will convene to present their perspectives on engineering mechanics research, again including Shahinpoor.

"Professor Nowinski was one of the best professors I ever had," Shahinpoor recalls. "Without exception, I learned something new every time I had a conversation with him as my Ph.D. advisor or every time I attended his lectures or classes."

Manufacturing Science Research at UD–ME

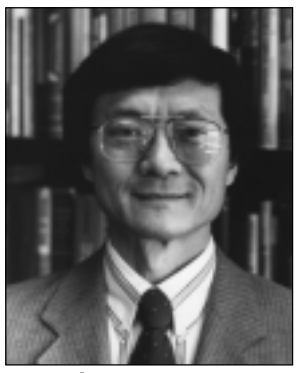
"To understand, control, improve, or invent a manufacturing process, we have to follow a series of prescribed steps," says Prof. Suresh Advani. "These include gathering material and process data from controlled experiments, developing a fundamental science base of the process, formulating a mathematical model that describes

the physics of it, and, finally, building simulations and creating virtual manufacturing scenarios." According to Advani, Interim Chair and one of nine faculty members conducting manufacturing science research in the Department, ME researchers have used these four cornerstones in a variety of manufacturing processes. Brief summaries are provided below. For more detail, see the Web pages of participating faculty.

S. G. Advani

Rapid Prototyping

Rapid prototyping (RP) provides valuable design tools for reducing product development cycle times by creating physical models. As a part progresses from concept to commercial reality, it is usually necessary to build prototypes for testing and modifications. Conventional tool development and fabrication can be time consuming and expensive. Low-volume prototype tooling is highly desirable if a limited number of parts can be produced quickly and economically. RP technologies can be applied to the production of such low-volume tooling. In addition, rapid tooling approaches have the potential to enable high-volume processes such as injection molding to be competitive at lower production volumes.

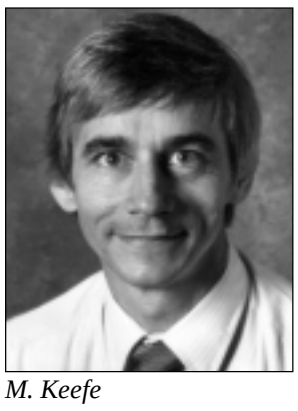


T-W. Chou

M. D . Greenberg

Coating Processes

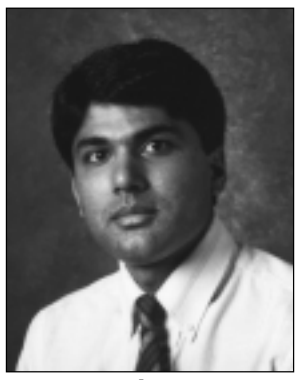
The application of liquid coatings to manufactured products is vital in most industries. Until recently, little attention was given to fundamental scientific issues, and techniques were discovered empirically. Department researchers are developing a comprehensive mathematical and numerical model for the fluid mechanics of coatings, including the effects of surface tension, substrate geometry, the energetics of wetting and spreading, and compositional rheology. Both continuous and batch processes are being modeled. Laboratory investigation complements the theoretical effort.



M. Keefe

Grinding Processes

Grinding is the preferred machining technique for ceramics, metals, and composites when a high-quality surface finish is required. Achieving high product quality requires careful control of the workpiece surface temperatures, as large temperature gradients can cause thermal warping and lead to a serious loss of dimensional tolerance. The objective of this work is to develop a model that predicts the surface temperatures of the workpiece when grinding with an oil-in-water emulsion coolant.



A. K. Prasad

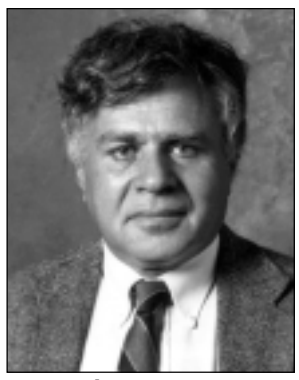
Static Mixing

Static mixers offer advantages such as low cost, compactness, lack of moving parts, and closed-system operation. This research is motivated by a desire to understand the effectiveness of static mixers over a range of operating conditions. Imaging techniques provide a nonintrusive, automated method to extract the degree of mixing.

V. R. Roy

Polymer and Polymer Composites Processing

Polymers, polymer blends, and composites are found in nearly one third of the world's products. This research focuses on understanding transport processes in composite materials and rheologically complex fluids. The physics fundamentals are also incorporated in numerical simulations to predict the flow and heat transfer behavior during manufacturing.



L. W. Schwartz

Fiber Preforming, Composite Microstructure, and Performance

In fiber-reinforced composite materials, the final material properties are inextricably linked to the manufacturing process. The goal is to identify the fundamental relationships among the manufacturing process, the composite microstructure, and the material performance, enabling tailored design. Recent advances include the development of textile preforming technology for fabrication of three-dimensional structures and the use of microwave heating to accelerate consolidation and processing for enhanced mechanical properties.

K. V. Steiner

A. Z. Szeri

In addition to Advani, ME faculty currently conducting research in manufacturing science include T-W. Chou, M. D. Greenberg, A. K. Prasad, M. Keefe, V. R. Roy, L. W. Schwartz, K. V. Steiner, and A. Z. Szeri.

1998 Gifts to Mechanical Engineering

Contributions of $1,000 and above:
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Dr. Dick J. Wilkins, Jr.

Consider Gift Giving As Part of Your Financial Plan

An important part of the gift planning process is deciding which charitable interests you want to support and the extent to which you wish to participate. Charitable gifts need not compete with your personal and financial goals. They may actually help you accomplish personal planning objectives in ways that benefit you, your loved ones, and your charitable interests. You may be surprised to learn, for example, that some gifts can be completed this year that offer immediate benefits to your charitable interests while helping to preserve long-term independence for you and your loved ones.

There are many ways in addition to cash to make charitable gifts during your lifetime. For example, special benefits are often associated with gifts of low-yielding appreciated securities or real estate. Giving careful consideration to the form and timing of your gifts is the starting point in deciding how best to make your gifts now and in the future.

There are also a variety of ways to fulfill your philanthropic goals as part of your estate plan. With federal estate taxes as high as 55%, significant tax savings may result. One giving option is a bequest, which may be arranged with the simple addition of a codicil (amendment) to your will. Other methods include gifts of life insurance, retirement plan benefits, and IRAs.

Another attractive option allows you to make a gift today but retain income for the remainder of your life or for a stated period of time. These plans also provide an income tax deduction in the year the gift is completed. Such charitable giving arrangements may be effective in planning for retirement income, caring for elderly loved ones, or providing funds for educational expenses. They can enable you to convert appreciated low-yielding assets into additional income without incurring capital gains tax at the time of the gift. Your gift can even result in significant amounts of tax-free income.

By exploring the various ways you can structure and time your charitable gifts, you can make a real difference in the lives of others while addressing your own tax and financial planning needs.

Your advisors can help you plan. The University also has planned-giving professionals on staff to assist you and your advisors in a completely confidential manner to explore taxwise ways in which you might support the work of the Mechanical Engineering Department. For more information regarding these and other ideas, please contact Paula M. Armstrong, Esq., Director Planned Giving, at 831-2104.

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