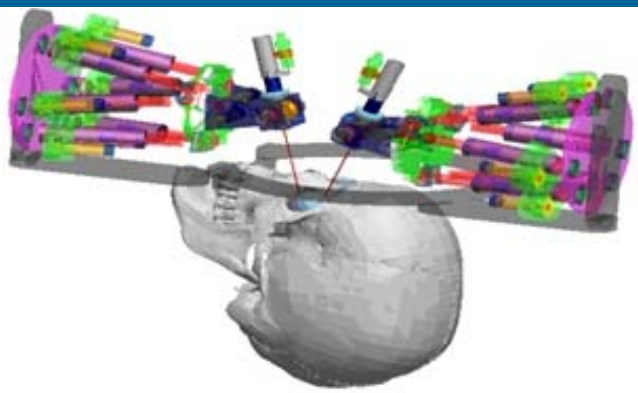
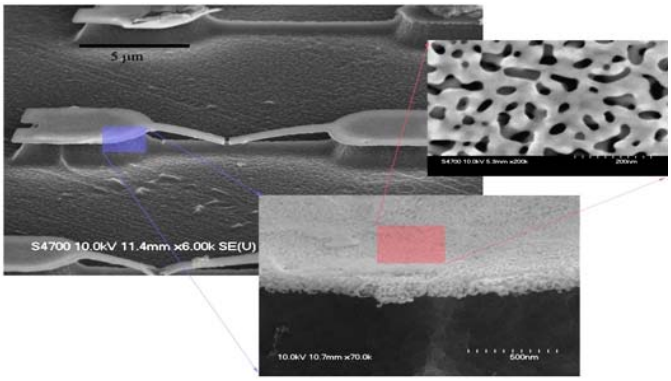
Fall 2008, Volume 1, Issue 1

Mechanical Engineering Newsletter

The Fu Foundation School of Engineering & Applied Science, Columbia University in the City of New York



A computer aided design (CAD) model of a dual-arm robot for ophthalmic micro-surgery (Prof. N. Simaan).



Micro-scale mechanical testing of nanoporous gold (Au) which has a very high surface area to volume ratio. This makes it well-suited for applications in sensing, actuation and catalysis (Prof. J. Kysar).

Message from the Chair

Dear Alumni and Friends,

These are exciting times for our department. Our undergraduate and graduate programs are vibrant and expanding, with about 100 undergraduates and close to 100 graduate students. Young, dynamic, and talented faculty have joined the department and brought with them interests and expertise in a variety of new and emerging areas. Research activities and interdisciplinary collaborations in particular have been on the rise significantly.

This is the inaugural issue of the ME Newsletter. Twice a year, the newsletter will celebrate the recent exciting developments in our department. It will highlight the latest research results, the special recognitions earned by our students and faculty, and other important activities. This newsletter is also a means of keeping in touch with all our alumni and friends of the department. We love to hear what you are doing (see page 8).

In this issue, the faculty recognitions and activities spotlight is on the PECASE award that Prof. Jeff Kysar received from the White House and the work on graphene pioneered by Profs. Jim Hone and Jeff Kysar and published in *Science.* We are also very pleased to report student activities such as Formula SAE as well as NSF teaching fellowship. The External Advisory Board (EAB)-sponsored Columbia-Berkeley Seminar Series and a one-day seminar at GE Global Research are also featured.

Please stay in contact with us by visiting us on campus and at our Web site (www.me.columbia.edu). If you have any comments you would like to share, please e-mail me at yly1@columbia.edu. I look forward to sharing more news with you in the future.

Best regards,

Y. Lawrence Yao
Professor and Chair

In this issue

CONGRATULATIONS GRADS!

BACHELOR OF SCIENCE, CLASS OF 2008

Abhishek Adhia, Edward Baronowski, Jeremy Baskin, Aisling Camps, Christopher Chang, Yun Chen, Jonathan Todd Chin, Shir Elany, Reid Ellison, Bethany Fisher*, Jeremy Giese*, Daniel Gross, Joseph Hall, Mohamed Haroun, Randall Johnson*, Ming-Du Kang*, Janusz Kesek*, Travis King*, Jeffrey Kingston, Duncan Kluwak, Ronald La Curan, Christopher Lum*, William Martin, Jairo Mateo, Carlos Maturana, Emmanuel Milienos, Marc Morgan, Ekleel Nadi*, Michael Nicholson-Meade*, Kelly Rickey, Margaret Rightmyer, Nicholas Sharma, Todd Spitz, John Teal, Nicholas Tucker*, Harry Van*, Rahul Vishwanath, David Xue, Laura Zahradnik*, Yiyi Zhang, Daniel Zuffante

***SPECIAL CONGRATULATIONS TO THE 2008 MECHANICAL ENGINEERING AWARD RECIPIENTS:**

The American Society of Mechanical Engineers Award: Janusz Kesek

James F. Parker Memorial Award: Nicholas Tucker

William A. Hadley Award in Mechanical Engineering: Ming-Du Kang and Michael Nicholson-Meade

Edward A. Darling Prize in Mechanical Engineering: Bethany Fisher

Excellence Award (1st Place) for Senior Capstone Design: Bike Brakers Team: Jeremy Giese, Randall Johnson, Christopher Lum, Ekleel Nadi, and Nicholas Tucker

Certificate of Merit (2nd Place) for Senior Capstone Design: Solar Water Heater Team: Bethany Fisher, Travis King, Michael Nicholson-Meade, Harry Van, and Laura Zahradnik

ACADEMIC YEAR 2008 MASTER OF SCIENCE

Edwin Ahn, Sung Wook Ahn, Sung Joo An, Amy Rachel Betz, Jonathan P. Bufort, Joseph L. Cacciola, Ken-Hung Chen, Arun Cherian, Tiffany Christatos, Tomasz Karol Cichocki, Joseph Coleman, Patrick Fink, Michael Brandon Grad, Suleman Khoja, Panagiotis-Spyr Kotsidas, Chia Wei Lai, Jason Lau, Frederick Albert Ledetsch, Chia-hui Lin, Zhiyong Lin, Christine Anne Livingston, Prithvi Naidu Mallarapu, Edward Musarskiy, Matther S. O'Neil, Gen Satoh, Eric Sporer, Matthew Stracker, Ricardo Vallejo Estrada, Jennifer Wong

MASTER OF PHILOSOPHY

Rajneesh Bhardwaj, Anubha Bhatla, Ranojoy Bose, Matteo Caligaris, Bhupesh Chandra, Rohit Chatterjee, Michael Kaplan, Wei Wei, Kai Xu, Jian Zhang, Yao Zhou

DOCTOR OF PHILOSOPHY

Rohit Chatterjee, Yuki Saito, Zhibo Zheng

From left to right: Seniors Harry Van, Michael Nicholson-Meade, Bethany Fisher, and Laura Zahradnik display their Certificates of Merit for Senior Design after Commencement.

Ph.D. Students Combine Research with Community Service

Andrew O'Grady, a Ph.D candidate in Mechanical Engineering, currently holds a GK12 fellowship from the National Science Foundation. The GK12 fellowship is offered through The Center for Technology, Innovation, and Community Engagement (CTICE). Since 2001 CTICE administered programs have provided 56 academic fellowships which have provided full-year funding for 35 different graduate students in SEAS.

Andrew explaining the wind tunnel operations to students.

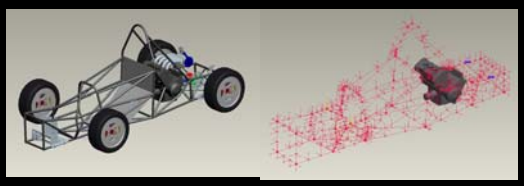
As part of his funding, Andrew works with The Hayden Engineering and Applied Science Program at Columbia, a weekend enrichment program for inner-city students in New York. The goal of the program is to expose the students (grades 8 -12) to real applications of science and technology which they would not encounter in their classrooms. "I've taught students about ME topics ranging from sustainable energy to aerodynamics. They also designed and built wings which we performance tested in our wind tunnel," explained Andrew. "The program is great because you can really see the students getting excited about science and being challenged in a way that they would not normally be in their classrooms," he continued. His advisor, Prof. **Vijay Modi** commented, "Andrew and our graduate students are as much enriched by community service as the high school students are." Andrew considers himself very lucky because his GK12 funding allows him to pursue his Ph.D. while also contributing to the local community in a meaningful manner.

For more information on the GK12 fellowship please visit www.ctice.columbia.edu

FORMULA SAE CLUB

From the sound of it, you might think we just build go-karts. You might imagine we just get a bunch of old parts, bolt them together, and buzz around someone's backyard in a thick cloud of our own exhaust. You might think that what we do is just a hobby.

Our race cars are designed and built to compete in the annual Formula SAE (Society of Automotive Engineers) collegiate design competition against the best engineering schools in the world. Each vehicle is developed according to strict SAE competition rules, guidelines established not only to keep us from splattering ourselves all over the pavement, but also to challenge students. Engine size and type is limited. The engine's intake is restricted, diminishing its power and forcing us to design to recover as much performance as possible. We are required to submit detailed reports on things like structural integrity and cost.



Pro/Engineer CAD Drawing

This wouldn't be possible if the team wasn't so fanatically devoted to the project. Maximizing performance while minimizing cost, or minimizing weight while keeping components sturdy requires a great deal of design consideration and time. The tubular steel chassis that is the backbone of the vehicle is designed and analyzed using Pro/Engineer CAD software, as are a number of other components. We use computational fluid dynamics simulations to optimize airflow through the intake and exhaust systems. And while the engine comes from a Honda motorcycle, most of the car's components are fabricated in-house.

The competition itself is held at Michigan International Speedway each spring. It includes static presentations, on topics like design, cost, and marketing, as well as dynamic on-track events which test the vehicle's performance.

The 2008 season was our best yet. While our 67th out of 120 placement might not suggest much, it was the first time we completed a car in a year, the first time the car ran in all four dynamic events, and of all the teams, we were one of only 40 that made it all the way through the endurance event without a breakdown.

But that's not the end of the story. Building on what we learned over the last year, we are currently developing the car for the 2009 season. We have a record number of new members this year. In addition to the competition, we are also a student chapter of the international SAE. For information, please contact Austin Brauser (ajb2145@columbia.edu) or visit the web site at www.columbia.edu/cu/sae.

The 2008 car
(at Michigan International Speedway)
Standing: Jake Amonette, Ryan Cornell, Islam Shawki, Mark Fisher, Austin Brauser, Mike Antonakakis, Damian Ancukiewicz, Arjun Roy, Henry Lau and Nick Tucker (Chief Engineer)
(not shown: Jonathan Battat)
Seated in car: Professor Fred Stolfi (Faculty Adviser)

2008 SENIOR DINNER

To honor our graduating class of 2008, the Department of Mechanical Engineering, in conjunction with the Columbia Engineering School Alumni Association (CESAA), held a celebratory dinner at Havana Central on May 2nd, 2008.

From left to right, Mrs. Kennedy, Mr. Kennedy, and Professor Larry Yao relax at the senior dinner.

'08 Graduate **Campbell Rightmyer** and her a cappella group, *Uptown Vocal*, regaled students, faculty, and staff with a half hour of spirited songs. Anna and Guy Longobardo (see pg. 4) were also in attendance representing CESAA. After a delicious, Latin-inspired dinner, distinguished ME alumnus **William D. Kennedy** (MS '72, Prof. Degree '79) spoke to the students, explaining some of his work as a tunnel ventilation and fire-life safety engineer and senior executive with Parsons Brinckerhoff.

A good time was had by all, notably those who challenged their professors in beer pong as well as those who headed to the dance floor afterwards.

Left to right: seniors Joseph Hall, Ronald La Curan, Campbell Rightmyer, Janusz Kesek, Rahul Vishwanath, and Prof. Fred Stolfi celebrate at the ME senior dinner.

SENIOR DESIGN: STUDENTS DRAW ON ANALYTICAL SKILLS AND CREATIVITY

Engineering Design, or as it is more commonly called Senior Design, is the capstone design course in the Mechanical Engineering Department. As a requirement for an accredited undergraduate degree by the Accreditation Board for Engineering and Technology (ABET), engineering students must design, fabricate and test a prototype of an original system. They need to draw not only on their analytical skills to predict system performance but also on their creativity to design an innovative concept. Senior Design also teaches students how to work in design teams to achieve a common goal. The 8 teams for 2008 were:

- **Bike Brakers Team** (a regenerative braking system for a bicycle)
- **Solar Heaters Team** (a low cost solar water heater for third world countries)
- **Ski Waxers Team** (a portable system for waxing skis)
- **Frisbo Team** (an electromechanical thrower which launches a Frisbee through a target)
- **Stair Climbers Team** (an autonomous system to carry packages up stairs)
- **Diver Trackers Team** (an autonomous flag boat which indicates a scuba diver position)
- **Drum Tuners Team (**a portable system for tuning a drum)
- **Wall Climbers Team** (a remote controlled robot which can climb vertical windows)

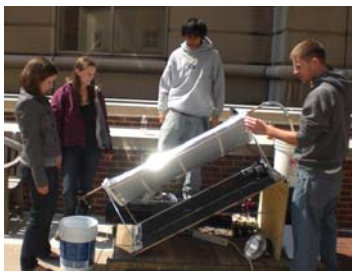
A portion of the grade for Senior Design is determined by a Design Committee formed from Columbia alumni, recent Mechanical Engineering student graduates and faculty from other engineering departments at Columbia. The Design Committee reviews the prototypes at a Design Expo, a trade fair style exhibit at the conclusion of the semester. The Design Committee also votes for the 2 best Senior Design projects.

The award for Excellence in Senior Project Design was given to Jeremy Giese, Randall Johnson, Christopher Lum, Ekleel Nadi and Nicholas Tucker (Bike Brakers Team).

The Certificate of Merit in Senior Project Design was awarded to Bethany Fisher, Travis King, Michael Meade, Harry Van and Laura Zahradnik (Solar Heaters Team).

In addition, Jeremy Baskin, Aisling Camps, Christopher Chang, Daniel Gross and Todd Spitz (Ski Waxers Team) were selected as finalists in the ASME Manufacturing Design Competition.

For more information, visit the web site at:
www.me.columbia.edu/seniordesigns



Solar Heaters Team testing their low cost solar heater.
Left to right: Laura Zahradnik, Bethany Fisher, Harry Van, Michael Meade, Team member not pictured: Travis King

Bike Brakers Team putting the finishing touches on their project.
Left to right: Randall Johnson, Ekleel Nadi, Christopher Lum, and Jeremy Giese
Team member not pictured: Nicholas Tucker

FUNDAMENTALS OF ENGINEERING (FE) EXAM

Beginning in 2006, the Mechanical Engineering Department has encouraged undergraduate students to take the Fundamentals of Engineering (FE) examination. This is the first step on the road to becoming a Professional Engineer (P.E.) and obtaining a P.E. Certificate from their state. For the students, this provides an additional line on their résumé, indicates a level of competency by passing a nationally standardized test and opens up additional career choices. In addition, the aggregate test results are analyzed by the department to help improve our undergraduate course content.

To help students pass the exam, a review course is offered in the spring semester. Material on the exam not taught in our required courses is presented, test taking strategy is discussed and sample problems are reviewed. A comprehensive sample FE exam is the final exam for the course. The table (*right)* shows the number of students taking the exam each year and the number who have taken the review course. The student success rate can be attributed to the strong academic caliber of the students as well as the preparation they receive in the course.

Year	Senior Class Size	Review Class Size	# Taking Exam	# Passed Exam	% Passed Exam	National Average for Mechanical Eng. % Passed Exam
2006	40	29	15	15	100	79
2007	56	32	31	29	94	84
2008	56	22	23	21	91	83

ME ALUMNI HIGHLIGHT: ANNA KAZANJIAN LONGOBARDO AND GUY LONGOBARDO

Anna Kazanjian Longobardo (BS'49, MS'52) and **Guy** (BS'49, MS'50, DES'62) **Longobardo** have had distinguished careers in industry and both were honored with the Egleston Medal for Distinguished Engineering Achievement, the highest award given by the Columbia Engineering School Alumni Association. They have also dedicated a great part of their time to supporting various organizations on campus as well as the Mechanical Engineering department where they met. Most recently, they endowed a scholarship specifically for mechanical engineering students.

Anna was the first female graduate from the ME program. As an engineering executive at Unisys Corp., she headed a world-wide organization supporting complex military and weather radar systems in more than 100 locations until her retirement in 1995. She has served in many leadership positions including as a University Alumni Trustee and is now Trustee Emerita. She was recently elected as the Chair of the External Advisory Board for Mechanical Engineering.

Guy, a former professor of the department, spent most of his career at IBM in systems and software development. He also managed the large systems plan for Europe, Middle East and Africa. However, he continued his work started at Columbia in the nascent field of biotechnology. His work was among the earliest bioengineering activity quantifying dynamic physiological processes in scientific and engineering terms. Dr. Longobardo has been active in the Columbia Engineering School Alumni Association, serving as president from 1988 to 1990.

The Department of Mechanical Engineering takes great pride in its association with Anna and Guy Longobardo. Larry Yao, the ME department chair said, "We remain indebted to them both and extend our gratitude for their continued involvements."

Anna and Guy Longobardo at the 2006 CESAA/SEAS Award Dinner where Guy received his Egleston Medal.

REKINDLING FRIENDSHIPS: CLASS OF 2003 REUNION

On Friday, May 13, 2008, more than half of the Mechanical Engineering class of 2003 (picture shown left was taken at the time of graduation) returned to New York for a reunion to rekindle friendships that developed during their time at Columbia. An invitation was extended to the faculty, and Professors **Yao**, **Modi** and **Longman** attended.

"Seeing all of the students again was very special. They're very happy and have made great progress in their careers," said Yao. **J.P. Kurpiewski** (back row, first from right), one of the top students of the class and organizer of the reunion, attended MIT and received his MS degree in Mechanical Engineering. He is working for Raytheon designing radar for the Ballistic Missile Defense System. J.P. has taken a leave beginning this fall to attend MIT Sloan and work towards his MBA. **Dan Benjamin** (middle row, first from right) began working for an energy consulting company after graduating. He then received his MBA from NYU and is now working for Sirius Satellite Radio in Rockefeller Center. **Sean Younger** (back row, fourth from left) continued to the University of Wisconsin-Madison for a MS degree in ME. He is now working for the US Patent and Trademark Office in Virginia. He finds his degrees to be very helpful at his current job because of the technical content involved. **Paul Rios** (middle row, first from left) received his MS in ME from Georgia Tech and is currently working as a marketing consultant in automotive engineering with ZS Associates. **Rachel Pryztula** (middle row, second from left) works for Turner Construction where she began as a field engineer and transitioned to work on projects and budget costs. She also just recently received her MBA from Fordham University. **Liz Martin** (front row, second from right) pursued her passion for music and works for the World Music Institute while completing her PhD in Ethnomusicology at the CUNY Graduate Center. **Patricia (Trish) Kern** (first row, first from right) currently works for Stantec in Philidelphia, an engineering consulting company. **Rosy Nograles** (first row, first from left) worked for Accenture doing IT consulting and is currently working for Conde Nast, a publishing company where she is part of their internet technologies department.

Professors Yao, Modi and Longman were very proud of the accomplishments of their students. "They have achieved much in the last five years in their personal and professional lives and we wish them the best in their future endeavors," said Yao.

EXTERNAL ADVISORY BOARD SUPPORTS DEPARTMENT

The EAB at the October 3rd, 2008 Meeting
Front Row: Michael Idelchik (outgoing EAB Chair), Anna Longobardo (Incoming EAB Chair)
Back Row: Darcy Hunter, Y. Lawrence Yao, Nicolas W. Chbat, Russell Taylor, Hitoshi Tanaka, William Kennedy, Glenn Wattley, Gregory Basso Not Pictured: Elias Anagnostou, Hie Jae Kim, Peter Luccarelli, Michael T. McGough, Mark Powasnik, Albert Pisano

The ME External Advisory Board (EAB) was established in Fall 2006 and convened its first meeting at Columbia University in September of that year. Composed of distinguished alumni and successful industrial, academic, and business leaders who have a high interest in the ME Department's success, the EAB provides advice and counsel to the Department regarding industry and other constituent needs and trends. The members of the EAB play an important role in helping shape and achieve departmental strategic goals. The former EAB Chair, **Michael Idelchik**, considers the EAB's most important contribution that of keeping the Department up to date in terms of industrial trends so that the curriculum can remain highly relevant.

"The EAB members also serve as advocates for the department," said the Departmental Chair, **Y. Lawrence Yao**. "They help reach out to a larger group of ME alumni and assist in recruiting high-quality faculty and students," he added.

The EAB meets on campus in the Fall and via conference call in the Spring semester. The Fall meetings includes an update of the department's current state and goals and have included lab tours. The board also meets separately to discuss and plan their recommendations for the department's direction and objectives. The EAB presents these recommendations to the ME faculty and action items are decided upon. The Fall 2008 meeting was held on Friday, October 3rd. Presentations on industrial trends were made by members representing General Electric (GE), Philips Research, and Northrop Grumman. GE emphasized initiatives in areas of energy research, Philips focused on a new paradigm in health care which included home based care that depends on wireless technology and advanced sensing and diagnosis technology, and Northrop Grumman highlighted computational mechanics to give prognoses of structure health.

For more information about the EAB, visit www.columbia.edu/cu/mechanical/pages/directories/EAB/index.html

In Memoriam

Herbert Deresiewicz, professor emeritus of mechanical engineering, died Sunday, June 8, 2008 after a long illness. Professor Deresiewicz spent more than four decades at Columbia SEAS, first as a student and later as a highly respected professor and three-time chair of the Department of Mechanical Engineering.

He was highly regarded as a teacher and was a recipient of the Great Teacher Award of the Society of Columbia Graduates. His students reviewed him favorably in Columbia course guides during his decades of teaching. Among the comments: "He is without doubt the best and most dynamic teacher in the department, organized, clear, relevant, obsessively accurate and informative" (Fall, 1986).

The Department of Mechanical Engineering is grateful for and honored by Professor Deresiewicz's legacy, commitment to excellence, and years of service. Professors **Ateshian** and **Yao** represented the department at the funeral service and expressed their sincere condolences to the family.

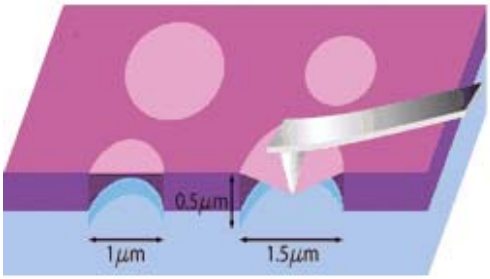
GRAPHENE CONFIRMED AS STRONGEST MATERIAL by David Porrata

James Hone's (pictured left) and **Jeffrey Kysar's** (pictured right) groups have completed the first strength tests on the carbon material graphene proving it to be the strongest material ever measured. Graphene holds great promise for the development of nano-scale devices and equipment. It consists of a single layer of graphite atoms arranged in a hexagonal lattice, similar to a honeycomb. As a two-dimensional material, every atom is exposed to the surface. It forms the basis of graphite fibers used in tennis racquets and other durable products. When rolled, very useful tiny tubes called nanotubes can be fabricated.

The studies were conducted by postdoctoral researcher **Changgu Lee** and graduate student **Xiaoding Wei**, in the research groups of professors James Hone and Jeffrey Kysar. The findings are published in the July 18, 2008 edition of *Science*: http://www.sciencemag.org/cgi/content/full/321/5887/385. "Our research establishes graphene as the strongest material ever measured, some 200 times stronger than structural steel," Hone said. "It would take an elephant, balanced on a pencil, to break through a sheet of graphene the thickness of Saran-Wrap."

Until now graphene's estimated strength, elasticity and breaking point, were based on complex computer modeling theories. Laboratory tests had been stymied because of two major experimental challenges: the complexity in mechanically grasping graphene specimens to measure their elongation under force, and the difficulty of making specimens small enough to be free of imperfections.

"Our team sidestepped the size issue by creating samples small enough to be defect-free," said Kysar. The team culled microscopic graphene samples, ones where every single atom is on the surface, from larger graphite crystals. These newly created, two-dimensional samples were then placed over small circular holes etched in silicon to create miniature circular films only one atom thick. The graphene adhered to the silicon because of the attraction between their atoms, solving the second challenge.



The scientists tested the strength of the films by pushing on their centers with a diamond-tipped atomic force microscope with a radius of 20 billionths of a meter. (See schematic illustration, left, of the nanoindentation on a suspended graphene membrane.) The absence of flaws in the samples, each about 1 micron in diameter or one percent of the width of a human hair, enabled the scientists to test both elasticity and breaking point properties. The scientists collected more than 67 test values on 23 separate films. "Until now, there's been no definitive set of experiments that people can use to validate or invalidate the computer simulations that model the mechanical properties of materials at strains literally up to the breaking point, " said Kysar. "It's important because this is a fundamental parameter for all types of materials. The Air Force wants to introduce new materials within a five-year cycle, versus 20 years now, so being able to predict the mechanical behavior of how a new material will fail under the most extreme circumstances will make it much less expensive and less time consuming to develop, and with better materials for everyday life."

"Though the strength of any practical material is still limited by many types of defects, the research can lead to a better understanding of the behavior of materials at extreme conditions, such as exist near the tip of a crack," said Hone. "This can in turn lead to far more robust materials, ones more resistant to oxidation and fatigue. Achieving a better understanding of how materials fail allows us to design and create newer, safer materials, and ultimately to build a safer, more efficient environment for us."

DEPARTMENT VISITS GE GLOBAL RESEARCH

On April 25th, 2008 eight members of the Mechanical Engineering faculty visited General Electric Global Research (GEGR) in Niskayuna, New York. The visit was envisioned to exchange diverse research efforts between the two organizations and to discuss possible collaborations.

The visit was initiated through a discussion between **Larry Yao**, the ME department chair, and **Michael Idelchik** (pictured), the Vice President of Advanced Technology of Global Research at GE who also served as the Chair of the External Advisory Board (EAB) for the ME department. The EAB provides the department with advise, counsel and support towards a successful future. As an alumnus of the department (BS, '78), Michael is invested in contributing to its development and to strengthening its connection with the industry.

During the visit, professors **Attinger, Hone, Kysar, Lin, Modi, Narayanaswamy**, and **Wong** each presented on their research while GE spoke about renewable energy and micro and nano technology. Idelchik attended most presentations. The SEAS Interim Dean, Dr. **Jerry Navratil**, who was at GEGR that day for a related event, attended a good part of these presentations with great interest.

Professor **Daniel Attinger**, who helped organize this visit, said: "This visit has spurred the collaboration between several faculty members and GE." Currently, Professor Wong is discussing research opportunities on optical sensors with the company. Professor Kysar collaborated with GE on a proposal for the Department of Energy and Professor Narayanaswamy also submitted a DARPA (Defense Advanced Research Projects Agency) proposal with them. Should the DARPA proposal be accepted, it will result in opportunities for research on thermal measurements on materials currently being developed by GE. "The visit was helpful and informative and the department looks forward to future collaborations with GERC," concluded Yao.

PROFESSOR KYSAR RECEIVES PECASE AWARD

Professor Kysar with Deputy Secretary of Energy Clay Sells

Associate Professor **Jeffrey Kysar** was selected for the highest honor that any young scientist or engineer can receive in the United States. He was awarded a Presidential Early Career Award for Scientists and Engineers (PECASE) and received the honor at a special award ceremony at the White House in early November, 2007.

Prof. Kysar was nominated for the award through the U.S. Department of Energy (DOE) for his outstanding fundamental research into the deformation of materials at small length scales, under high-strain-gradient, and under high-rate-loading conditions. His research concentrates on the mechanical properties of materials at small length scales and under extreme conditions. “The overall thrusts are to develop verified, physics-based predictive models of mechanical behavior and to develop new nanostructured materials that can be employed in microscale and nanoscale devices,” he said.

“I am deeply honored to be a recipient of the PECASE award,” he continued. “This recognition would not have been possible without strong support from the Mechanical Engineering Department, the School, and the central administration of Columbia University. I am grateful to have developed strong research collaborations with colleagues both in and out of the Mechanical Engineering Department. I especially thank the members of my research group for their hard work and their commitment to excellence in research,” he said.

The PECASE was established in 1996 to recognize and honor outstanding scientists and engineers at the outset of their independent research careers. The award was instituted to foster innovative developments in science and technology, increase awareness of careers in science and engineering, give recognition to the scientific missions of participating agencies, enhance connections between fundamental research and national goals, and highlight the importance of science and technology for the nation’s future.

Department Chair Y. Lawrence Yao cited Prof. Kysar as “most deserving of this extraordinary honor” and praised him for being not only a superb scholar but also an excellent mentor and a valuable colleague.

Prof. Kysar also expressed gratitude to Columbia's Materials Research Science and Engineering Center (MRSEC), the National Science Foundation, the Air Force Office of Scientific Research, the Academic Quality Fund at Columbia University, the New York State Office of Science Technology and Academic Research, and the U.S. Department of Energy for their continuing financial support of his research.

PROFESSOR WONG RECEIVES NSF CAREER AWARD

Assistant Professor, **Chee Wei Wong**, was awarded an NSF CAREER Award for $400,000 to study “Nonlinear and nonclassical optics in ultra-high-Q/V mesoscopic cavities.”

“Recent important advances in sub-wavelength nanostructures offer extraordinary control over the properties of light,” says Professor Wong. “In particular, we can now manipulate the propagation, storage, and generation of light, as well as practically prescribe—through geometry—the interaction of light with matter based on first-principles." He continued, "This is a fascinating are with rapid advancements and there's much to examine and explore."

The NSF CAREER Award is one of the NSF’s most prestigious awards in support of the early career-development activities of those teacher-scholars who most effectively integrate research and education within the context of the mission of their organization.

Through his dedication, Professor Wong has very successfully integrated his research with the educational goals of the ME Department. He joined the faculty in 2004 and benefited greatly from the unwavering support of the Department. He has published over 60 journal and conference papers, has given over 20 invited seminars, and has 5 patents with 10 other patents pending. Additionally, Professor Wong has served on over 15 PhD thesis committees at Columbia. He was also awarded the 2007 DARPA Young Faculty Award for studies in high-Q/V cavities and their deterministic control.

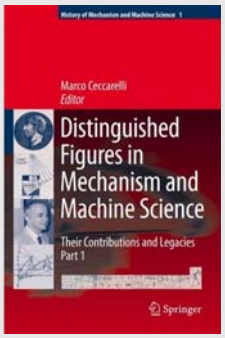
COLUMBIA BERKELEY SEMINAR SERIES: A Partnership that Highlights Research in Micro/Nanotechnology

The External Advisory Board (EAB) is composed of accomplished leaders in their respective fields in academia and the engineering industry. They provide support and guidance to the ME Department on its mission to not only prepare for today's workforce but also for a successful future. A member of the EAB is Dr. **Albert P. Pisano** (pictured left), who is currently the Director of the Berkeley Sensor & Actuator Center (BSAC) and Chair of the Mechanical Engineering Department at UC Berkeley. Dr. Pisano is also an alumnus of Columbia University's Department of Mechanical Engineering, from which he received his B.S. (‘76), M.S. (‘77), and Ph.D. (‘81) degrees. He and other EAB members were impressed by the direction that the Department has taken and they reaffirmed their assessment by noting that the Department is currently building a significant forward momentum. This new and energized momentum is a result of careful planning and implementation of strategic goals and the efforts of creative faculty members who are willing to pursue new and unconventional research directions in the field of Mechanical Engineering. Specifically, Dr. Pisano was excited about the research conducted in Micro/Nanotechnology, his own area of expertise. Dr. Pisano suggested increasing our interactions with his colleagues at Berkeley to provide new avenues of collaboration and highlight the work of our faculty members in the area of Micro/Nanotechnology.

Taking up Dr. Pisano's proposal, Professor **James Hone** visited him at Berkeley in November 2006 to plan for such increased interactions. As as result, a joint seminar series between Columbia and Berkeley in the area of Micro/Nanotechnology has emerged. Each semester, at least one faculty member active in the research area from each university will pay a visit and present a seminar at the counterpart institute. Professor Hone gave the inaugural seminar titled *Nanotube Nanomanufacturing: Controlled Assembly, Mechanical and Electromechanical Testing, Molecular Circuits and Fuel Cells* at Berkeley on January 31, 2007. Dr. **Pisano** visited Columbia in Spring 2007 and presented a seminar titled *MEMS and Nano Technology for the Handheld, Portable Electronic and the Automotive Markets*. Additional seminars have included *Microlectromechanical Systems for Thermal Characterization and Manipulation of Biomolecules* by Professor **Qiao Lin** from Columbia in Fall 2007 and *Mechanical Engineering in Micro/Nano System Revolution* by Professor **Liwei Lin** from UC Berkeley in Spring 2008. Prof. **Chee Wei Wong** is scheduled to present a seminar on *Engineering Photons through Nonlinear Dynamics in Nanosctructures* at Berkeley on February 3, 2009. The department looks forward to participating in additional seminars and collaborations.

For more information about the series, visit http://www.columbia.edu/cu/mechanical/misc-pages/CUBSeminarSchedule.html

Book on "Distinguished Figures in Mechanism and Machine Science" Published -- Honoring Professor Ferdinand Freudenstein by Richard Longman



Springer recently published a hardbound book on distinguished figures in mechanisms and machine science, edited by Marco Ceccarelli, with four pictures on the cover. The first is a portrait of Archimedes, the second a kinematic diagram from Théodore Olivier from the 19th century, the third is a photo of Ferdinand in his office, and the fourth is a machine designed by James Watt. In the Table of Contents we see a chapter on Ferdinand and chapters on others such as Copernicus and Heron of Alexandria (c. 10-85 AD). He is in good company. Professor Freudenstein (1926-2006) is often referred to as the father of modern kinematics.

He received his PhD from the Mechanical Engineering Department at Columbia in 1954. In his PhD dissertation he developed an elegantly simple equation to represent the closure constraint on a planar four-bar mechanism, and this became known as the Freudenstein equation. He was appointed an Assistant Professor at Columbia the same year. To quote the book, his career up the academic ladder was meteoric. In less than three years he became Associate Professor, and in two more years Full Professor. In the mean time, one year after becoming Associate Professor he took on the Chairmanship of the Department. He retired from Columbia as Higgins Professor Emeritus in 1996 after 42 years on the faculty.

Five months after his death, Professor Pierre Larochelle of the Florida Institute of Technology compiled a list of Freudensteins's academic descendents. This family tree which is printed in the book, but is also available on the web (http://my.fit.edu/~pierrel/ff.html) and periodically updated, contains the names of each of his PhD students, and the names of each of their's, etc., reaching into the fifth generation. It contains over 500 names and includes a large number of the important names in the field. His influence was worldwide. I can attest to traveling to places like Kanpur in India, or places in China, or Turkey, and mentioning that I come from Columbia University. Often the immediate response was to talk about Ferdinand Freudenstein.

Part of the charm was the fact that someone so important in his field could be such a soft spoken and modest man, a gentle person that everyone liked, and someone you would consider to be very wise. And so, the family tree really does have the flavor of family. The chapter on Ferdinand was written by Professor Bernard Roth, his second doctoral student. Perhaps around 1985 Bernie visited Columbia and the three of us went to lunch at the Faculty Club. Bernie asked how many students were at Columbia, and Ferdinand and I answered simultaneously. I said about 15,000 and he said about 25,000. I had only been at Columbia for 15 year and Ferdinand for only about 35 years, we both thought we ought to know by now. Later I learned we were both right, my number was for Columbia University, his for Columbia University and affiliated institutions.

Ferdinand was very good at finding fields outside of traditional kinematics and making them address important kinematics problems, such as the use of graph theory in creating mechanism theory. He was also very good at finding people to collaborate with in this process, and from this I directly benefited. One favorite example problem of his was lifting rigs, whose stability he analyzed based on kinematics. He came into my office and posed the problem, and we wrote a paper making use of dynamic stability theory. Later he came into my office and wanted to work on design of cams using optimal control theory, and we co-advised Meng Sang Chew (now on the faculty of Lehigh) and published a paper that got an ASME Best Paper Award. I have published multiple papers on this subject afterward, some co-authored with him, and even have a current doctoral student making use of improved computational methods for this problem. It was always a joy to collaborate with him. At other times I would see him in his office talking to someone from Bell Labs about heuristic optimization, or Professor Primrose from England would be visiting, etc.

We all miss F^2, as he was often called, and we are very pleased to see his face appear (together with Archimedes) on the cover of a book on distinguished figures in his field.

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Professor Y. Lawrence Yao, Chair
Dept. of Mechanical Engineering
The Fu Foundation School of Engineering and Applied Science
Columbia University in the City of New York
220 Mudd Building, MC 4703, 500 West 120th Street
New York, NY 10027

FACULTY NEWS

Jung-Chi Liao joined the ME faculty in September 2008 (A feature article on Dr. Liao will be included in the next issue). Two graduate students, Bhavik Nathwani (from Texas A&M) and Yunde Shi (from SJTU, China) have joined his lab this semester.

Richard Longman recently delivered keynote lectures in Ho Chi Minh City (Saigon), Vietnam, Heidelberg Germany, and at the 4th Asian Space Conference in Taipei, Taiwan. In summer '08 he spent time working at the National Applied Research Laboratories in Taipei and at the Interdisciplinary Center for Scientific Computing at the University of Heidelberg. He just finished his term on the Fellows Awards Committee of the American Astronautical Society, and is currently serving on the scientific committee for upcoming conferences in Taiwan and in Hanoi, Veitnam.

Vijay Modi has, over the last three years, started a new line of inquiry jointly with colleagues in the Earth Institute on looking at technologies and policies that enable energy services and infrastructure in developing countries. He is currently in the second year of work on a five-year grant from the Bill & Melinda Gates Foundation focusing on improving low-cost energy services (cooking and lighting) as well as in developing decision-support and modeling tools for rural electrification. He is also supporting the infrastructure efforts within the Millennium Village Project, currently in ten countries across sub-Saharan Africa.

Fred Stolfi received patent number 7,204,584 for work that he had previosly done while at Xerox Research. He participated in a workshop at Marquette University with Mechatronics engineers from Procter & Gamble, Rockwell Automation and the University of Michigan.

Elon Terrell joined the ME faculty in September 2008 (A feature article on Dr. Terrell will be included in the next issue). He recently had a paper accepted into the Journal of Tribology entitled "A Particle-Augmented Mixed Lubrication Approach to Predicting Chemical Mechanical Polishing."

Y. Lawrence Yao has recently completed his two-year term as the Scientific Committee Chairman for the North American Manufacturing Research Institute, which held its latest annual meeting in Northwestern University in October 2008.

We welcome submissions for our department newsletter. Please send your news and your contact information to the address below or send an e-mail to:

seasinfo.me@columbia.edu

Chair
Y. Lawrence Yao

Editors
Sagrario Hernandez, Rebecca Penix-Tadsen, Y. Lawrence Yao

Contributing Authors
Ryan Cornell, Sagrario Hernandez, Margaret Kelly, Richard Longman, Andrew O'Grady, Rebecca Penix-Tadsen, David Porrata, Fred Stolfi, Y. Lawrence Yao

Photos/Images
Jeffrey Kysar, Anna Kazanjian Longobardo, Vijay Modi, Andrew O'Grady, Rebecca Penix-Tadsen, Fred Stolfi

Department of Mechanical Engineering
The Fu foundation School of Engineering and Applied Science
Columbia University in the City of New York
220 Mudd Building, MC 4703
500 West 120th Street
New York, NY 10027

Phone: 212-854-2966
Fax: 212-854-3304
www.me.columbia.edu
seasinfo.me@columbia.edu

Department of Mechanical Engineering
The Fu foundation School of Engineering and Applied Science
Columbia University in the City of New York
220 Mudd Building, MC 4703
500 West 120th Street
New York, NY 10027