

QUADRANGLE

university of hawai'i college of engineering

Message from the Dean

Aloha,

It is with the greatest pleasure that I offer my greetings and my first formal message to you, the friends and supporters of the University of Hawaii College of Engineering. I feel most fortunate to be at the helm of this College where I have met extraordinary faculty members; outstanding, award-winning students; and a team of colleagues throughout the University system who are enthusiastic and appreciative. For this, I thank you. It bodes well as I look to the future of this institution. We have a fertile platform with enormous potential.

As I look to our future I see

Rankings: a national class engineering college enjoying steadily increasing rankings in the U.S. News and World Report listings;

Differentiation and Distinction: a college that is recognized within the Pacific Rim for its unique and distinctive characteristics emanating from its roots in the Hawaiian and Asia-Pacific

communities, its ocean environment and its East-meets-West location;

Workforce Engine: a college that delivers and services a growing proportion of the workforce needs to the State

of Hawaii across an increasing spectrum of engineering disciplines and is thereby instrumental in attracting and retaining high-wage companies to the State while sustaining the vital infrastructure needs of the State and the U.S. Department of Defense;

Teaching Excellence: a college that earns a stellar national reputation for its educational programs and individual student attainment, continuing its 100-year-old educational tradition of attracting a large number of Hawaii's K-12 science-oriented (STEM) students;

Research Strength and Diversity: a college with 100 faculty supporting a sustained \$40 million, internationally competitive annual research budget in collaboration with other units from UH and around the world, and spanning the entire range of activities from highly speculative federally-sponsored programs to short-term technology transfer programs sponsored by local companies.

It will be this vision that will guide me as I seek to build on the excellence that I have found existing in our College. We have much to be proud of already; and I am enabling a process that will bring our success stories to more public attention.

Allow me to expand on my hope to capitalize on our College's unique position in the midst of the islands of the Pacific, bringing together a multi-cultural diversity of students and faculty in a location that is bound in all ways to our ocean environment.

continued on back cover

Fall 2006 Highlights:

Technology for a Better Tomorrow

Career Awards

Network Security

Nanobrush

Internship Experience

Donors



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Dr. Gurdal Arslan



Dr. Albert Kim

Prestigious Awards from **National Science Foundation** and **UH Board of Regents** Received by **Outstanding Faculty**

By Carrie Matsuzaki The College congratulates two faculty members who recently received prestigious CAREER awards from the National Science Foundation (NSF). Drs. Gurdal Arslan, assistant professor of electrical engineering, and Albert Kim, associate professor of civil and environmental engineering, will each receive \$400,000 over a five-year period to support both research and educational activities in their chosen areas. Dr. Arslan's topic is "Cooperative Systems Design – Stochastic Games Approach" and Dr. Kim's award is entitled "Aggregate-Enhanced Membrane Filtration."

According to NSF, the Faculty Early Career Development program (CAREER) was established in 1994 to recognize "the critical roles played by faculty members in integrating research and education, and in fostering the natural connections between the processes of learning and discovery." This is the most prestigious award given to junior faculty members by NSF and its intent is to encourage the integration of research and education. Faculty will hopefully develop careers as outstanding teacher-scholars with the level and longevity of support provided by a CAREER award.

Dr. Arslan is working with cooperative systems, which are large-scale systems made up of many components making autonomous decisions based on locally available information; these decisions need to be coordinated to achieve an overall objective. For example, drivers making routing decisions to reach their destinations in a shared transportation system as quickly as possible, or mobile phone users trying to communicate over a shared communication system can be regarded as cooperative systems. In order for the drivers or mobile phone users to use the shared resources as efficiently as possible while achieving their own individual objectives, cooperation needs to exist between them.

Developing theoretical and computational tools to enable cooperative behavior is one goal of Dr. Arslan's project. He will use game theory as the basis of his work. Game theory studies competitive interactions ranging from cooperation to conflict. Originally used for economics, game theory has been expanded for use in mathematics, biology, analysis of cold war strategies and various other areas. A particular area of game theory, stochastic games, is what Dr. Arslan will focus on. Stochastic games model competitive processes that evolve over time with transitions that formalize the uncertainties and therefore can be used as a mathematical framework to obtain cooperative solutions among the involved stakeholders.

Integrating this research into the classroom involves developing new courses, training graduate students, preparing teaching materials, developing an interactive website and recruiting students to become involved in this research area. Game theory is rarely taught in engineering so its application is underutilized. Dr. Arslan's CAREER grant will enable him to bring this theory into the classroom.

Dr. Albert Kim's CAREER award on "Aggregate-Enhanced Membrane Filtration" will use Beowulf clusters made up of Linux-based computers. These clusters run high-performance computing tasks. Beowulf supercomputers facilitate high-speed parallel computations, thereby allowing complex calculations to be performed more rapidly, accurately and efficiently. Dr. Kim is developing simulation algorithms that can be used to predict the effectiveness of water filtration processes and then test these algorithms using the Beowulf system.

Various filtration methods are employed in conventional water and wastewater treatment to remove particles such as suspended solids, colloids, macromolecule and bacteria from suspensions. These particles become trapped on the surface of

or inside the filters, thereby slowing or stopping the filtration process. In order to make the filtration process more effective, Dr. Kim will simulate the hydrodynamic, physical and chemical interactions between the suspended particles/biocolloids and the surface of the membrane. Numerous variables need to be considered, which is why Dr. Kim needs the processing power of Beowulf supercomputers. Results of his research will enhance the production of clean water, the world's most precious resource.

Dr. Kim's project, like Dr. Arslan's, has an educational component that will bring his state-of-the-art research into the classroom, where he hopes to encourage students, especially local students of Asian or Hawaiian ancestry to become engaged with scientific inquiry. He also sees the potential for integrating the local students with international students, encouraging them to collaborate with each other to strengthen their abilities to communicate and cooperate.

Outreach to the high schools and the development of new courses are also in his action plan.

ABOUT DRS. ARSLAN AND KIM:

Dr. Arslan earned his PhD in electrical engineering in 2001 from the University of Illinois at Urbana-Champaign and joined UH COE in 2004. His thesis was on the "Robust Adaptive Control of Deterministic and Stochastic Strict-Feedback Systems."

After completing his PhD thesis on the "Dynamics of Particle Accumulation at Engineered and Natural Interfaces" in 2000 within two and a half years at the University of California, Los Angeles, Dr. Kim spent a year as a post doctoral researcher at the Institute for Environment at UCLA. He joined the Civil and Environmental Engineering Department in 2001 as an assistant professor. Dr. Kim is also a recipient of the 2006 Regents' Medal for Excellence in Research. The Board of Regents presents this award in recognition of scholarly contributions that expand the boundaries of knowledge and enrich the lives of students and the community.

**This is
the most
prestigious
award
given to
junior
faculty
members
by NSF**

**The prototype
is designed
for simple
surgeries
in the
abdominal
region**



Developing Technology for A **Better** Tomorrow

By Kaipo Tam The world may not fully appreciate that engineers quietly spark the origins of new technology every day. Dr. Peter Berkelman, assistant professor in mechanical engineering, is most certainly such an engineer, helping to improve technology in the critical health care arena of the surgical operating room. Having received his PhD in robotics engineering from Carnegie Mellon, Dr. Berkelman works toward improving surgical devices so that operations may be performed more easily, accurately and safely.

Current surgical robots are very costly, and bulky machines take up considerable space in the limited confines of the operating room. Dr. Berkelman's prototype design proves to be drastically more lightweight and compact, incorporating much smaller mechanisms to perform required surgical tasks.

The prototype is designed for simple surgeries in the abdominal region, such as on the appendix and gallbladder. Positive features include easier set-up, better access to the patient during surgery, and simpler sterilization procedures. Software has been developed to sense and record movements made by separate instruments that the doctor uses to control the robots during surgical procedures and to move the robotic instruments.

Dr. Berkelman and his graduate assistant, Ji Ma, are currently collaborating with surgeons at the Queen's Medical Center to further improve the system.

Preserving Hawai'i's Groundwater

By Kelli Ching Several projects are underway at the College of Engineering to maintain and protect Hawai'i's groundwater. Dr. Chittaranjan Ray, a civil and environmental engineering professor, is currently managing three projects studying the flow and transport of pesticides, chemicals, and pathogens through the soil into Hawai'i's groundwater.

The first project evaluates the transport of newly-registered pesticides in Hawaiian soils. Funding is provided by the U.S. Environmental Protection Agency through the Hawai'i State Department of Agriculture. The focus of this project is to test the movement of new pesticides through the soil to the groundwater. "We must perform additional testing before allowing new chemicals into the market," states Dr. Ray. Research is performed at five locations: three on Oahu, one on Kauai, and one on Maui. The outcome of this project will enable the State to decide which new chemicals can be used freely, which should be given certain restrictions, and which should be prohibited.

For example, an important hazard to Hawai'i's groundwater can be found in the pineapple-growing areas of Hawai'i. Low levels of bromacil, an herbicide used for weed control, have appeared in the groundwater. The State and the Pineapple Growers Association are currently studying new methods of prevention or reduction of bromacil contamination. One such solution is to apply bromacil at lower application rates and control the weeds using other techniques or tools.

The second project evaluates the transport of wastewater contaminants in Hawaiian soils. Funding is provided by Brown and Caldwell, a local company, and the Honolulu Board of Water

Supply. There are four main chemicals present in wastewater: surfactant degradation products, estrogenic hormones, pesticides, and nitrosodimethyl amine (NDMA). Dr. Ray and his fellow researchers test to see if these chemicals will make their way into the groundwater. Dr. Ray states, "Although these four chemicals do show up in the tests, the concentration is so low that they will not show up in the groundwater." More lab work was performed with higher concentrations of the chemicals to see if a higher dose would produce a different outcome. "The surfactant degradation products and estrogenic hormones do not even pass through the soil and while NDMA is the most mobile of the four chemicals, it is still in such low concentrations that it is not affecting the groundwater," stated Dr. Ray.

Dr. Ray's most recent project evaluates the transport of antibiotics and pathogens in Hawai'i soils. Farm animals such as pigs, cows and chickens are given antibiotics, which go to manure lagoons. When the manure is applied to soil, they may have some chance to seep into the underlying groundwater. Dr. Ray works in collaboration with the U.S. Department of Agriculture and is also testing whether the bacteria and pathogens expelled from the animals have the potential to move through the soil and find their way into the groundwater. Researchers are currently collecting various soil samples from around Oahu and have maintained that red soil is a very good filter to retain bacteria and prevent groundwater contamination.

Dr. Ray's research has thus far demonstrated that Hawai'i's groundwater is still safe and free of harmful contaminants. He continues to work to prevent future contamination of this precious resource.



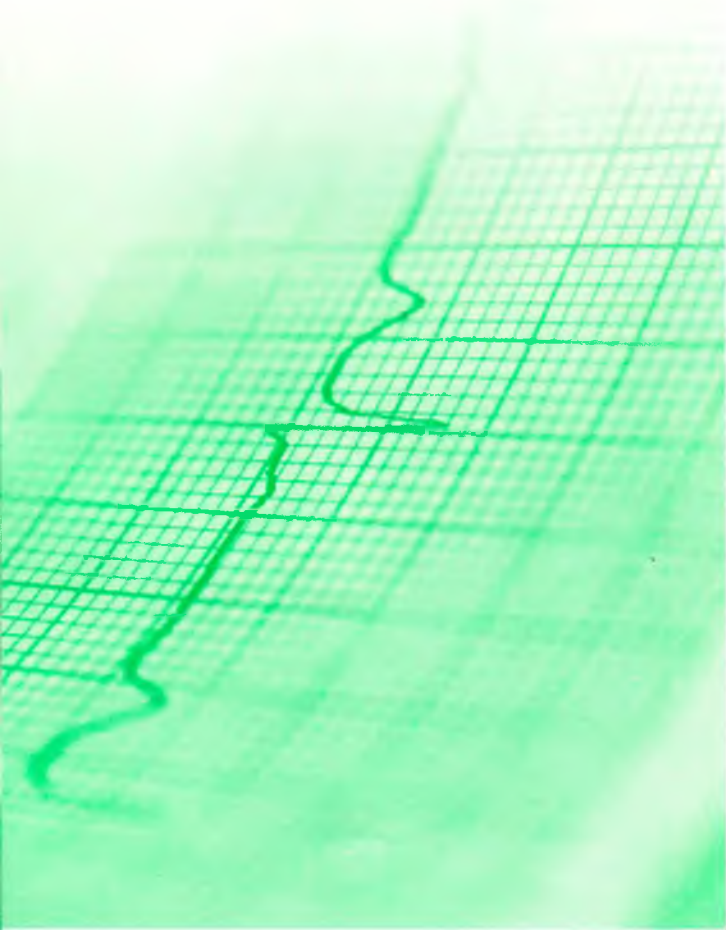
Heart Sensing

By Faye Yuen Dr. Victor Lubecke, with his wife and fellow electrical engineering professor, Dr. Olga Boric-Lubecke, have developed innovative technologies with enormous potential benefit to the health care field. The couple, in collaboration with Professor Anders Host-Madsen, and in conjunction with undergraduate and graduate students, is conducting bio-medical research to monitor heart rates and breathing through non-invasive methods.

The concept behind remote sensing is to have radio waves projected onto, and then scattered off, a body. The reflected waves are then analyzed and observed for changes due to motion. For example, a contracted heart would be smaller than an un-contracted one, thereby increasing the distance the signal must travel to and from the heart. By observing these changes in distance with each heartbeat, the heart rate can be accurately determined. By using such wireless signals the issues of tangled wires and biomechanical rejection are no longer major problems.

This technology is ideal for monitoring conditions requiring ongoing chronic abnormalities such as sleep apnea or heart rhythm irregularities. It has also caught the interest of the military, particularly in the area of reconnaissance. Information previously unknown to strategists, such as how many terrorists are in a building or what numerical odds soldiers would be facing in an upcoming battle are invaluable. Other uses include post-disaster rescue, baby crib monitors and vehicle safety.

The Lubeckes are committed to providing students with engineering projects for which they can personally feel proud. According to Dr. Lubecke, "In this type of research students can see the value in what they're doing in addition to gaining problem-solving skills necessary to succeed as future engineers."



**Lubecke Team
Develops
Technologies
Beneficial to
Health Care
and Beyond**



Professor Develops New Security Methods for Protecting Important Servers



By Faye Yuen Cyber threats on the Internet have become a widespread epidemic that has led to the inevitable demise of a threat-free collaborative working environment. Researchers have proposed various approaches to prevent spoofing; however, none have been widely accepted due to the associated cost and overall deployment requirements.

For the past few years, Dr. Yingfei Dong, electrical engineering professor, has been conducting research to develop effective methods to stop unwanted packets from reaching important servers. This means protection for clients beyond usual firewalls and secure shell applications. Two such methods developed by Dr. Dong are Lightweight Internet Permit System (LIPS), and DiffMail for new email service architecture.

The Lightweight Internet Permit System (LIPS) is based on a concept similar to that of a lock and key in which only the proper key will allow access to what lies inside. The key to LIPS is its access permit. To obtain an access permit, a source requests it from its destination. Once the destination has identified the source as being "safe", it grants an access permit that is inserted into each packet bound for that destination. The

destination identifies and accepts only those packets with the proper access permit. When tested on a Linux platform, LIPS was successful in reducing common spoofs and unsolicited packets.

DiffMail defies conventional "sender-driven" methods by giving the control to receivers over which messages to accept. This receiver-pull model allows the receiver to retrieve packets "if and when" he chooses. Thus, if the receiver knows what he wants to receive, he can prevent unwanted senders from injecting unwanted traffic.

According to Dr. Dong, both methods provide a better chance of surviving an attack as well as making an attack more difficult for cyber criminals.

As Internet availability becomes increasingly accessible to all, it is important that we apply appropriate safeguards that protect both our identities and privacy. In the future, Dr. Dong hopes to continue collaborating with partners in government, private industry and academia to address and establish appropriate defense responses that can be implemented across the board.

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Internship Nets Positive Results for Students and Private Firms

By Ryan Okahashi There is often great uncertainty among undergraduate students about survival in the “real world” after graduation. Will “book smarts” translate into practical engineering application? I have found that an internship was an excellent avenue for gaining practical, on-the-job experience among great mentors.

I had the opportunity to participate in a part-time internship with SSFM International, a design consulting firm. While undergraduate engineers can obtain information about internships by attending the College of Engineering Career Day, I became familiar with SSFM because I am one of their scholarship recipients.

During my internship, I gained valuable

experience in my field of study. It gave me practice interacting and working with fellow colleagues and the ability to implement what I learned in school. For example, I was able to assist in checking the “as-built” drawings and making necessary changes on the sheets. I also worked on spreadsheets consolidating contractors’ unit costs for various materials. I obtained valuable hands-on experience using AutoCAD to make changes to drawings, making sure, for example, that a site drains properly and performing the relevant calculations, just as I had learned in my classes.

Sometimes it can be hard to work and go to school at the same time. Fortunately, SSFM was flexible with my schedule and provided a half-day work program so that I could get to my classes. Despite the challenges in scheduling, I know that the experience of “getting my feet wet” before graduation will pay off in the end. In fact, some of my friends had internships that turned into full-time jobs soon after they graduated.

One of the best choices I made in my educational career was to participate in an internship to gain the real-world experience while still learning in school. I am grateful to SSFM for providing me with this opportunity as well as their generosity in making my scholarship available to me.

“One of the best choices I made in my educational career was to participate in an internship”



UH Mānoa Engineers Create **World's Smallest** Nanotube Brush

The smallest nanotube brushes with bristles more than a thousand times finer than a human hair have been created by a team of researchers from UH Mānoa and Rensselaer Polytechnic Institute of Troy in New York. The invention will be included in the 2007 issue of the Guinness Book of World Records.

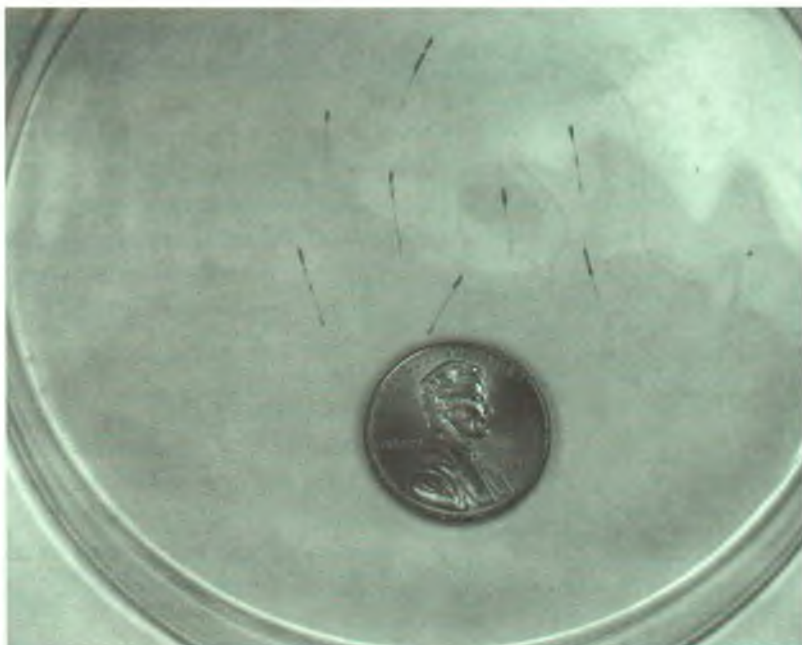
The brushes can be used for sweeping up nano-dust, painting micro-capillaries and even cleaning up pollutants in water. Researchers demonstrated that the brushes can also perform as electronic micro-switches (where the carbon nanotube bristles

provide electrical connections as the brush turns using a micro-motor). On a larger scale, the carbon nanotube brushes can conduct electricity when used in electric motors. The strength of the brushes is resistant to abrasion and pliability, and may prove superior to macroscopic

metal brushes in high-power motors.

The research team includes Dr. Mehrdad Ghasemi-Nejhad and Dr. Anyuan Cao, UH Mānoa faculty; Mr. Vinod Veedu, UH Mānoa doctoral student; and Dr. Pulickel Ajayan, Rensselaer Polytechnic Institute faculty.

**Multifunctional
tool accepted
by Guinness
World Records**



ASCE **Steel Bridge Team** Advances to **Nationals**

By Laura Shimabukuro The COE student chapter of ASCE (American Society of Civil Engineers) placed third in the Steel Bridge Competition during the 2006 ASCE Pacific Southwest Regional Conference at UCLA this spring. The placement qualified them for the national competition held at the University of Utah at the end of May. Seventeen schools from Hawai'i, Arizona, Southern California and Nevada attended the conference and competed in a variety of competitions.

The team designed their bridge with efficiency in mind. Long hours were spent, well into the night, perfecting their design utilizing AutoCad and Sap2000. Throughout the design and fabrication process, the team acquired practical information and

experience, such as how to weld while fabricating the bridge and working with critical fabrication tolerances and weld integrity.

MacSteel donated all the steel used for the team's bridge, while many other private companies, ASCE and the College of Engineering helped fund the trip for the team to travel to the conference.

The Steel Bridge Team comprised the following members: Bryan Lum (captain), Renee Ishisaka, Kim Tanaka, Brandon Weaver, Brendon Hayashi, and Travis Nishino.

Congratulations ASCE Steel Bridge Team!



Engineering **Banquet**

The April 2006 banquet netted over \$90,000 to support lab equipment at the College. We thank our many supporters who enjoyed the event with us. Mark your calendars for the next banquet: April 18, 2007.



Message from the Dean

continued from front cover

In order for the College of Engineering to compete successfully against the array of strong, world-class engineering programs in the U.S. and the rest of the world, it must develop distinctive programs that will differentiate it from its peers. We must build programs and strengths that take advantage of unique assets such as the Hawaiian and Asia-Pacific cultures, the ocean environment and the East-meets-West location.

I recently had the opportunity to listen to highly-respected leaders of native Hawaiian ancestry speak at the Hawai'i 2050 Sustainability Conference. I took note of the ancient Hawaiian land management system, defined by the *ahupua'a*, the feats of engineering that enabled the orderly management of fish ponds; and the astronomical and navigational talents of those who plied the sea in open canoes. It struck me that these bodies of knowledge may be tapped yet today as inspiration to modern engineers.

Of course, there needs to be a well-articulated strategy for reaching any vision. Besides building our uniqueness and programs to differentiate ourselves, we must build partnerships, especially with our stakeholders such as the State, the local industries and businesses that support us, the families and students that pay tuition, and the community colleges and schools that feed us our new students and prospective engineers. We must become much more visible and reach out both internally at UH to prominent units such as SOEST

(School of Ocean and Earth Science and Technology), the John A. Burns School of Medicine, the Shidler College of Business, the College of Education and the School of Architecture; and externally to the local community, the Pacific Rim and the entire nation through our alumni and other friends of the College. We must initiate many research and teaching programs by tapping the enormous research and teaching capability of UH and, finally, we must vastly diversify our funding and support mechanisms so that we can carry out the ambitious plans we will be setting forth.

I look forward to sharing more specific components of my vision for the College of Engineering with you in the next year or so. We will be utilizing this newsletter and other venues to elaborate the many initiatives that I expect to be launched from the College. I shall of course update you on these initiatives in this newsletter as we proceed. During the first several months of my tenure, I shall be eagerly listening and so I would be grateful for any comments, critiques and ideas you may have. Please know that my mind is open as I learn about my new home. I hope to hear from you.



Dean Peter Crouch

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