

UCLA Civil & Environmental Engineering

UCLA HENRY SAMUELI SCHOOL OF ENGINEERING AND APPLIED SCIENCE | FALL 2014/WINTER 2015

By the Numbers

2

National Ranking in Ph.D. Graduates
Per Faculty Member Per Year*

18

Ladder Faculty

3

Faculty Added
in 2014-15

1544

Freshman Applicants
for 2014-15

26

Ph.D. Graduates
2013-14

2

Affiliated
NAE members

63

Freshman Enrollees
for 2014-15

*Based on 2010 National Research Council data

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Class of 2014

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Alumnus of the Year

Message from the Chair

— PROFESSOR JONATHAN P. STEWART —



Thank you for taking a few moments to read our Fall 2014 newsletter.

I am delighted to report that three new faculty have joined our department – Mathieu Bauchy and Henry V. Burton as assistant professors, and Michael J. McGuire as an adjunct professor.

Drs. Bauchy and Burton were appointed based on their extraordinary academic and professional records, but also to grow the department in strategically vital areas related to next-generation, high-performance civil engineering materials and multi-scale seismic risk mitigation for structures and communities. Dr. McGuire is internationally renowned for seminal contributions to water treatment. He is also a member of the National Academy of Engineering.

Our continuing faculty had an exceptionally productive academic year in 2013-2014, graduating 26 Ph.D. students. This rate of 1.6 Ph.D.s/faculty member is remarkable. To place the number in context, consider that the five top CEE programs according to the 2014 *U.S. News & World Report* rankings average about .75 Ph.D.s/faculty member. Programs ranked from 6 to 30 by *U.S. News* average about .33 Ph.D.s/faculty member, according to National Research Council data. The takeaway: UCLA is consistently among the top, and for 2014 was likely the top, graduate research program in the U.S. as measured by Ph.D. productivity.

Those graduate students are conducting vitally important research addressing some of the most significant infrastructure-related problems facing California and the nation. Many go on to leadership positions in CEE industry, while others continue in academics as faculty members and researchers (three recent Ph.D. graduates were placed in academic jobs in 2013-2014).

At the undergraduate level, we continue to attract the brightest and most driven students in CEE from California and across the nation. For the 16th year in a row, UCLA attracted the most freshman applicants of any university in the U.S., more than 1,500 of whom were CEE applicants. We have enrolled from that group 63 freshmen, making this year's class the most selective yet and continuing a trend of increasing selectivity in admissions. When they graduate, these students are prized by the engineering industry and top graduate programs nationwide (approximately one-third of our graduates enter graduate programs, including our own). The industry interest is reflected by substantial growth this year in our UCLA CEE Partners program, which is described further on the back cover.

I appreciate your interest in, and support of, CEE at UCLA. Please read on, and Go Bruins!

Jonathan P. Stewart, Ph.D., P.E.
Professor and Chair

This work relies heavily upon large-scale experimental testing, high-performance computing for structural simulations and reliability theory.

Current research projects include the development of a rocking spine system as a cost-effective strategy for new design and seismic retrofit of concrete buildings, and formulating a framework and computational tools to model post-earthquake recovery at the community scale.

What do you value most about your work?

My ability to inspire students to think critically, realize their individual talents, become independent learners and make meaningful contributions to society.

Anything else we might like to know?

I am originally from Trinidad and Tobago, a twin island nation in the southern Caribbean. I am a member of the American Society of Civil Engineers, the Structural Engineers Association of California, the Earthquake Engineering Research Institute and the National Society of Black Engineers.

New Faculty Profile: Mathieu Bauchy

Mathieu Bauchy joins UCLA from MIT, where he was a postgraduate researcher.

What are your research interests?

My initial studies focused on computational physics and condensed matter, topics for which I earned a Bachelor's degree from Ecole Normale Supérieure de Cachan and a Master's degree from Université Pierre et Marie Curie (both in France). But as I pursued my doctoral studies at UPMC, I felt the need to apply my interest in fundamental physics to materials that are relevant for industry and society.

I developed models to understand the composition, topology and properties of glasses. This approach has been used by Corning Inc. to design Gorilla Glass, ultra-strong glass used for the screens of most smartphones and tablets on the market.

My research is now focused on a range of materials with relevance to engineering and industry: glasses, ceramics and cementitious materials. Cement alone is responsible for 8% of global CO₂ emissions, which makes urgent the need for new concretes featuring improved properties.

What are your research goals?

I seek to reduce the gap between fundamental physics and engineering, both by teaching and research.

Physicists can bring new viewpoints to civil engineering problems, and can greatly gain from the expertise of the engineering community in return. Eventually, I believe that a multi-disciplinary approach can result in the design of new, improved and sustainable materials that can satisfy our infrastructure needs and make a real impact on our society.

What brought you to UCLA?

The quality of the students, the internationally recognized leadership, and the high potential for local collaborations convinced me that UCLA is the ideal place to establish my research program.

What most interests you about your work?

I greatly value the daily diversity professors have the privilege to experience regarding research, teaching and mentoring. Every day, I find it incredibly rewarding to face different research questions, to exchange ideas with motivated students, and to be challenged by the rising expertise of my mentees. Perhaps the greatest satisfaction comes from the students who get inspired and wish to embrace a career in academia.



New Faculty Profile: Henry Burton

Henry Burton joined the UCLA faculty after working as a structural engineer and receiving his Ph.D. from Stanford University in 2014.

How did you become interested in your field?

After high school, I was unable to immediately attend college because of financial reasons. However, I was fortunate enough to land a job in the estimating department of a construction firm. This experience gave me my first peek into the world of civil engineering, and I fell in love with what I saw.

What drew you to UCLA?

The faculty appear to me to be a close-knit and collaborative group. In addition, the strong reputation of the department and university at large gives me the confidence that I will be able to attract high-caliber students to my research group.

What are your research interests?

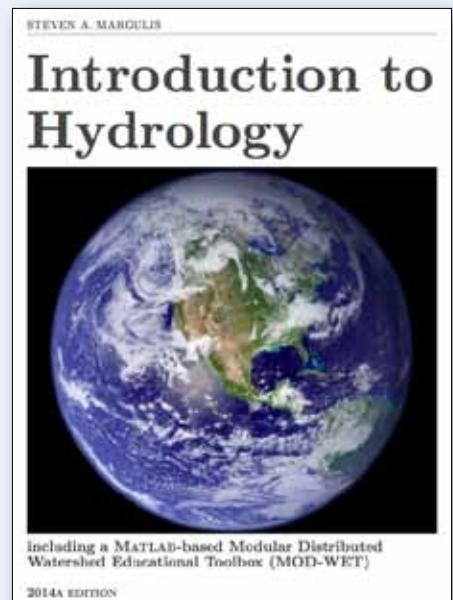
My current research is broadly focused on improving the resilience of urban communities to natural disasters.

Specific areas of interest include developing enhanced earthquake-resistant building systems, performance-based life-cycle design and assessment techniques, and nonlinear structural modeling and seismic collapse simulation of buildings and community resilience.



Margulis Writes the Book on HYDROLOGY

Open access e-text includes multimedia features, computational tools



Professor Steven Margulis has never found the perfect text for his Introduction to Hydrology course. So he wrote the book himself, publishing the open-access e-text "Introduction to Hydrology" in July.

The text has received a warm reception. First, Margulis' students offered positive feedback as he assembled and used parts of the book in his courses over the past two years. Now, faculty at more than a dozen other universities – including the Massachusetts Institute of Technology, the Georgia Institute of Technology, two other UC campuses and Denmark Technical University – are using the book as required reading or reference material.

"Keeping it open access serves a few purposes," Margulis said. "First, textbooks are expensive for students, so making the material accessible via a free download is helpful. In addition, the agencies that fund our research want us to contribute to undergraduate learning in important ways, and this helps serve that purpose."

Margulis, who joined the UCLA faculty in 2002, also said the open-access strategy is helpful for incorporating multimedia features from sources including the COMET program established by the National

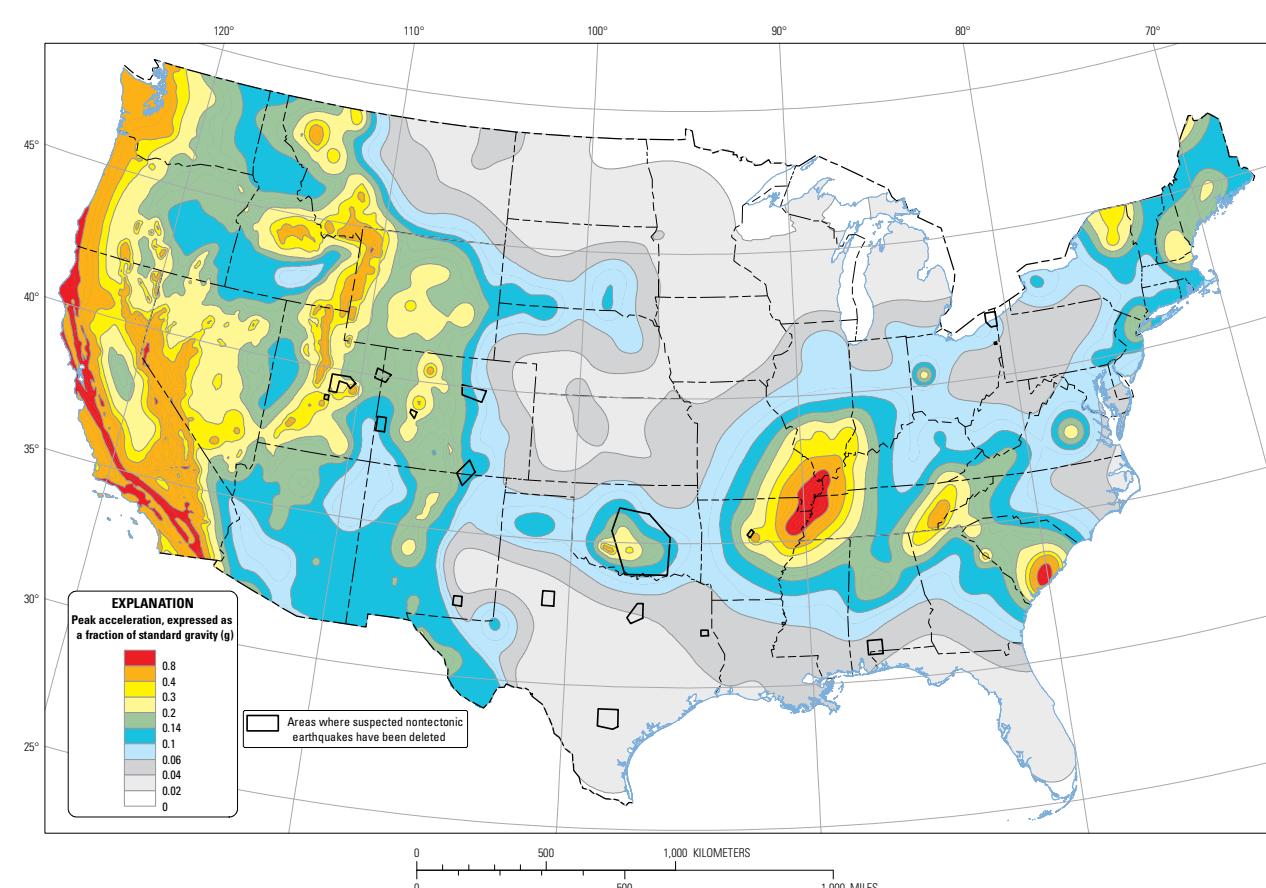
Weather Service and the non-profit University Corporation for Atmospheric Research.

One novel aspect of the book is an accompanying Modular Distributed Watershed Educational Toolbox (for use in a MATLAB environment), which integrates concepts introduced in the text with computational tools that can be applied to a range of engineering problems, including modeling of watersheds and solar energy experiments.

A link to "Introduction to Hydrology" can be found at the Margulis Research Group site, aqua.seas.ucla.edu/~teaching.html.



Steven Margulis



Two-percent probability of exceedance in 50 years map of peak ground acceleration

Source: USGS

UCLA Contributes to U.S. Seismic Hazard Maps

UCLA CEE researchers and alumni played a significant role in developing the National Seismic Hazard Maps released by the U.S. Geological Survey in 2014.

The maps display earthquake ground motions for various probability levels across the United States and are applied in seismic provisions of building codes, insurance rate structures, risk assessments, and other public policy.

The USGS National Seismic Hazard Mapping Project developed these maps by incorporating information on potential earthquake sources and associated ground shaking obtained from the best available science and engineering models. These models were vetted through public workshops involving hundreds of participants and were reviewed by several science organizations and state surveys. Advice was also sought from expert panels and a steering committee.

UCLA civil engineering alumni who played a role in developing these maps, especially for the western United States, include Kenneth W. Campbell (PhD '77); Timothy Ancheta (Geology '01, MS '06, PhD '10); and Emel Seyhan (MS '06, PhD '13). Department Chair Jonathan P. Stewart worked with Seyhan and several other collaborators to develop state-of-the-art ground motion prediction models used in the mapping process. Christine A. Goulet (MS '04, PhD '08) has a lead role in developing similar models for central and eastern portions of the U.S. Those models will be used in future versions of these maps.

As a result of this work, it is no exaggeration to state that virtually any structure designed and constructed in the western U.S.—and soon throughout the U.S.—will be positively influenced by research conducted by UCLA CEE alumni and faculty.



Inside the Industry Advisory Board

Q: What do you see as emerging directions in civil and environmental engineering?

Lew: When I entered UCLA as a freshman back in 1967, it seemed like civil engineering was a static science. All the formulae and procedures were set. Now I see the pace accelerating. There have been great developments in understanding behavior of soils and construction materials such as timber, steel and concrete. Modeling methods are being refined. There is more interaction between civil engineers and other professions, making interdisciplinary work a necessity; civil engineers need to understand how their discipline interacts with the environment and communities. I think this may be the big challenge for research in the future.

In addition, seismic engineering is an increasing global need. There is a great migration of population worldwide to ever-increasing mega-cities. Many of these mega-cities are located in areas that are vulnerable to all types of natural hazards, including earthquakes. The real challenge for reducing the hazards will be to implement multi-disciplinary solutions; there is too much fragmentation because of discipline or geography.

Q: Why did you become involved in the IAB?

A: My primary intention was to be a positive influence in helping the department advance. The IAB provides valuable feedback to the CEE Department about the needs of the industry, but it also gives industry the connection to the CEE Department.

Q: What are the benefits of the IAB to your company and the school?

A: AMEC is a big international company, and it is important for AMEC to be connected to the academic community at each of its locations. Not just to faculty, but also to the students who will become our engineering leaders.

We have arranged for students to take field trips to construction sites that give them insight into how design and analysis culminates in building and successful completion. We have supported activities such as the EERI Undergraduate Seismic Design Competition (where UCLA finished in first place two years in a row). AMEC has offered internships to CEE students and has hired CEE graduates who have contributed greatly to the success of our company. We have also had opportunities to work with UCLA faculty in consulting roles, where their expertise and knowledge has been successfully applied in practice.

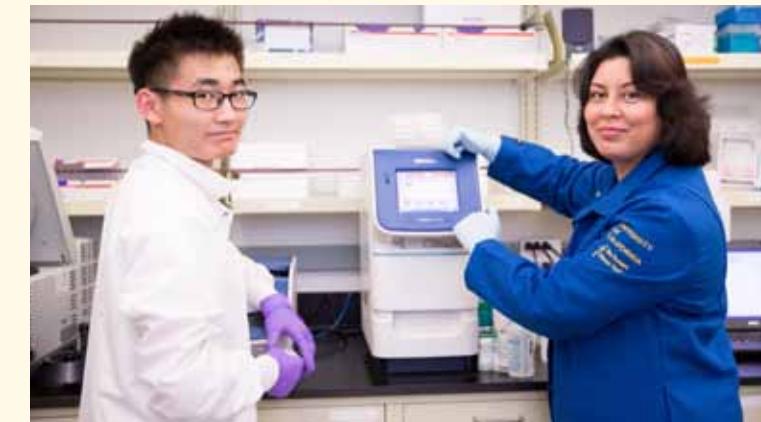
As a variety of firms are represented on the IAB, the students and faculty have many available resources beyond UCLA.

Q: In what ways has UCLA's CEE Department changed since you were here as a student?

A: I'm almost afraid to admit that when I attended UCLA there was no Civil and Environmental Engineering Department. There was a unified undergraduate engineering curriculum with a breadth of courses including electronics, mechanics, thermodynamics and computer science, as well as civil engineering. It wasn't until graduate school that I became more "civil" with the help of Professors Gary Hart, C. Martin Duke, Ken Lee and Stanley Dong, to mention only a few.

Today the CEE Department is focused on providing the fundamentals of civil engineering to undergraduate students. Faculty are on the leading edge of technology, but are well rooted in the fundamentals. The UCLA CEE Department is a research powerhouse that has changed practice and influenced building codes, its work not just dead-ending in technical papers found in little-read journals. I feel justified to be proud that I graduated from UCLA. Go Bruins!

RESEARCHERS DEVELOP SUSTAINABLE WAYS TO FIGHT TOXIC INDUSTRIAL WASTE



Graduate student researcher Meng Wang and Assistant Professor Shaily Mahendra.

Responding to the urgent need to develop sustainable, cost-effective technologies for cleaning up soil and water containing hazardous substances, CEE Assistant Professor Shaily Mahendra and her students have identified ways of using naturally occurring fungi and bacteria to battle contaminants.

Mahendra's group has established biochemical pathways, identified bacteria and fungi, and designed analytical, isotopic and molecular biological tools for monitoring biodegradation of contaminants including perfluorinated compounds (PFCs).

PFCs are probable carcinogens widely used in fire-fighting foams, non-stick coatings, stain-resistant textiles and insulation. They are found in the food chain as well as in air, soil and water sources.

Mahendra's group recently published in Environmental Science & Technology the first report describing the use of environmental fungi to biodegrade PFCs.

Mahendra is also collaborating with Leonard Rome, a professor in the UCLA Department of Biological Chemistry,

whose lab was the first to discover vaults – naturally-occurring particles found in a wide range of organisms. The hollow structure of vaults allows for proteins and other molecules to be packed inside. Vaults can be used in a range of

potential biomedical and environmental applications, including delivery of bacterial or fungal enzymes to wastewater or groundwater contaminated by heavy metals, petroleum hydrocarbons and solvents.

"Vaults are expected to be more stable under diverse biogeochemical conditions, cheaper and long-lived than free enzymes and live microbes," Mahendra said. "As a result, the need for repeated injection of active cultures or stimulation with nutrients to biodegrade dangerous materials is eliminated. Utilizing vaults could enable the widespread application of this technology to a large number of contaminated sites, resulting in lower material and energy inputs for environmental remediation."

The research is funded by the Department of Defense's Strategic Environmental Research and Development Program.



Lessons from the Northridge Quake

Professor John Wallace speaks during the Northridge 20 Symposium at UCLA in January 2014. The event, which was held on the 20th anniversary of the magnitude 6.7 Northridge Earthquake, drew hundreds of earthquake engineers, policymakers and others to share information about seismology, building safety and design, emergency preparedness and more.



Ph.D. Graduate	Faculty Advisor	Thesis
Kamil Bekir Afacan	Scott Brandenberg	Evaluation of Nonlinear Site Response of Soft Clay Using Centrifuge Models
Muhammad Ghulam Barik	Terri Hogue	Estimates of Evapotranspiration for Hydrologic Modeling in the Upper Colorado River Basin
Manuela Girotto	Steven Margulis	A Snow Water Equivalent Reanalysis of Variability in the Sierra Nevada Snowpack
Christopher William Hilson	John Wallace	Studies of Reinforced Concrete Structural Wall Boundary Elements
Seongwon Hong	Jiann-Wen "Woody" Ju	Self Healing Formulations for Bituminous Composites
Catalina Marambio Jones	Eric Hoek	Antiadhesive and Antibacterial Coatings for Biofouling Control
Kristijan Imre Kolozvari	John Wallace	Modeling of Cyclic Shear-Flexure Interaction in Reinforced Concrete Walls
Dong Youp Kwak	Scott Brandenberg and Jonathan Stewart	Probabilistic Evaluation of Seismic Levee Performance
Shih-Po Lin	J.S. Chen	Computational Framework for Stochastic Micro-Cracks Informed Damage Model
Tiffany Yi-Ling Lin	Jennifer Jay	Effects of Bacterial Growth and Aquaculture Practices on Mercury and Arsenic Contamination
Sami Maalouf	William W-G Yeh	Planning and Design of Desalination Plant Effluent Systems
Camille Marodon	J.S. Chen	Methods for Meshfree Approximation of Problems with Singularities and Discontinuities
Caroline Mini	Terri Hogue	Residential Water Use and Landscape Vegetation Dynamics in Los Angeles
Christopher Motter	John Wallace	Large-Scale Testing of Steel Reinforced Concrete Coupling Beams in Shear Walls
Kartiki Shirish Naik	Michael Stenstrom	Decentralized Wastewater Management for Improved Public Health Protection and Reclamation
MaryTheresa Monahan Pendergast	Eric Hoek	Self-Assembled Materials as Novel Nanotechnology-Enabled Ultrafiltration Membranes
Peerapong Pornwongthong	Shaily Mahendra	Stable Isotopic and Molecular Biological Tools to Validate Biodegradation of 1,4-Dioxane
Edward Thomas Reinert	Scott Brandenberg and Jonathan Stewart	Shake Testing of a Model Levee on Peaty Organic Soil in the Sacramento-San Joaquin Delta
Vincent C. Reyes	Shaily Mahendra	Differential Response of Environmentally Relevant Microorganisms to Metal Nanomaterials
Michael Jason Roth	J.S. Chen	A Reproducing Kernel Particle Formulation for Modeling Shock Effects in Nonlinear Solids
Zhan Shu	Jian Zhang	Seismic Responses and Protection of Building Systems
Vanessa Thulsiraj	Jennifer Jay	Evaluation of Methods for Tracking Sources of Fecal Pollution in Coastal Watersheds
Jinwen Wang	Eric Hoek	Removal of Trace Organic Pollutants by Nanofiltration and Reverse Osmosis Membranes
Yu-Kai Wang	Jiann-Wen "Woody" Ju	Multi-Level Micromechanical Modeling of Bone Tissues
Yi Wu	Jiann-Wen "Woody" Ju	Micromechanical Damage Models for Continuous Fiber Reinforced Composite Materials
Wang Xi	Jian Zhang	Performance-based Implementation of Seismic Protective Devices for Structures



CEE STUDENT CLUBS ENHANCE THE UCLA EXPERIENCE

American Society of Civil Engineers (ASCE)

President: **Max Armenta**

2013-2014 was a big year for ASCE. To list just a few accomplishments: We increased membership to finally break the 200-member mark, earned honors as UCLA Engineering's "Large Engineering Club of the Year," and took second place in the ASCE Pacific Southwest Conference Environmental Design Competition. This year, we look forward to getting all civil engineers engaged in their major through our projects, professional development events and social activities.



California Geoprofessionals Association (CalGeo)

President: **Clint Bannout**

In the 2013-2014 academic year, CalGeo at UCLA increased its membership to include more than 40 undergraduate and graduate students from civil engineering, geology and engineering geology majors. CalGeo at UCLA also organized its sixth annual Geo-Expo, which was attended by more than 40 guests from industry. In the upcoming year CalGeo at UCLA plans on having a larger presence with the CalGeo parent organization and at Los Angeles Geo-Institute professional development events.



Chi Epsilon (XE)

President: **Michael Tsai**

The four pillars of Chi Epsilon, the Civil Engineering Honors Society, are: Character, Scholarship, Practicality, and Sociability. Chi Epsilon offers opportunities for students to learn topics not taught in school, including: Wood Design, AutoCAD, Construction Management, and FE Exam Preparation. Chi Epsilon has a wealth of resources for all engineers who want to pursue a graduate-level education or develop marketable skills in today's industry.



Earthquake Engineering Research Institute (EERI)

President: **Ben Turner**

Following victories in 2012 and 2013, our undergraduate seismic design competition team competed at the annual EERI meeting in Anchorage, Alaska, this summer and performed very well. The EERI student chapter reconvened this spring to elect a new board of officers. In the upcoming year we plan to host several guest speakers and are planning workshops on seismic retrofitting and post-earthquake reconnaissance. <http://www.studentgroups.ucla.edu/eeri/>



Institute of Transportation Engineers (UCLA ITE)

President: **Casey Tona Le**

UCLA ITE is a great resource for students to get hands-on experience with and exposure to the transportation industry, as well as on-going transportation projects. In 2013-14, we had a strong turnout of students and faculty for our Rideshare Panel, which included representatives from companies including Uber and Sidecar. This year, we plan more events to connect students to industry and will assist with UCLA's Civil Engineering career fairs.

Yacov Haimes Named CEE DISTINGUISHED ALUMNUS

University of Virginia Professor Yacov Y. Haimes (MS '67, PhD '70) has been named the UCLA Civil and Environmental Engineering Department Distinguished Alumnus of the Year for 2014.

Haimes is the L.R. Quarles Professor of Systems and Information Engineering and the founding director of the Center for Risk Management of Engineering Systems at the University of Virginia.

After earning a Ph.D. with distinction from UCLA, Haimes joined the faculty at Case Western

Reserve University, where he later chaired the Systems Engineering Department. As an American Association for the Advancement of Science-American Geophysical Union Congressional Science Fellow in 1977-78, Dr. Haimes served in the White House Office of Science and Technology Policy and on the House of Representatives' Science and Technology Committee. Haimes joined the faculty at the University of Virginia in 1987.

He is a Fellow of seven societies: AAAS, the American Society of Civil Engineers, IEEE, the International Council on Systems Engineering, the American Water Resources Association, the International Water Resources Association and the Society for Risk Analysis, where he is a past president. He has authored or co-authored seven books, and is the recipient of numerous awards and honors, including the SRA 2010 Distinguished

Educator Award and the 1997 Warren A. Hall Medal, the highest award presented by Universities Council on Water Resources.

"Dr. Haimes has been a leader in the application of systems analysis methods to infrastructure problems for over 40 years," said William W-G Yeh, the Richard G. Newman AECOM Distinguished Professor of Civil Engineering at UCLA. "One particularly noteworthy accomplishment is his pioneering work (with Warren Hall) on the development of the surrogate worth trade-off method for multiobjective analysis, which is well known worldwide for water resources planning and management."

In 2013, the Distinguished Alumnus Award was shared among two alumni – Soroosh Sorooshian MS '73, PhD '78, a distinguished professor at UC Irvine; and Robert Englekirk, MS '65, PhD '78, founder and chairman emeritus of Englekirk Institutional.



"Dr. Haimes has been a leader in the application of systems analysis methods to infrastructure problems for over 40 years."

William W-G Yeh



Taking Research from the LAB TO REAL LIFE

CEE Professor Eric Hoek saw his nano-composite, reverse-osmosis membrane technology go from inspired idea to venture-backed startup company in 2007. This year he saw the company, NanoH2O Inc., acquired for more than \$200 million by Seoul, South Korea-based LG Chem.

Hoek is now at work on another start-up, Water Planet Engineering. Water Planet is commercializing a new polymeric-ceramic membrane – developed by Hoek and Richard Kaner, a professor of chemistry, biochemistry and materials science – that separates oils and other suspended solids from water that is co-produced during the oil and gas extraction process. Hoek gained experience with water treatment in the oil and gas industry during the summer of 2010, when he served as a consultant during the oil spill cleanup in the Gulf of Mexico.

Hoek said his business endeavors have been an education for him, and that they benefit his students.

"What I learned from NanoH2O is the mechanics of the process of starting up a company, the legal issues and the market forces that you need to consider," Hoek said. "I believe that entrepreneurial forays by faculty actually make us better teachers. We can mentor from real experience, and students respect and listen to that."

**WATER PLANET
ENGINEERING**

"Entrepreneurial forays by faculty actually make us better teachers. We can mentor from real experience, and students respect and listen to that."

Eric Hoek

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The UCLA-CEE Partners Program

Pairing faculty, staff and students with civil engineering firms, contractors utilities, government agencies and foundations, the UCLA-CEE Partners program offers a wide range of benefits to members.

- Special opportunities for student recruitment at career fairs and info sessions
- Opportunities for collaborative research with CEE students and faculty
- Certificate programs for employees to receive on-campus training

- Complimentary invitations to CEE and UCLA Engineering events and seminars
- Recognition on the CEE Department website and in CEE Department publications
- Much more

For more information:

Visit: www.cee.ucla.edu/partners
Email: eeskes@seas.ucla.edu

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