Our newest colleagues bring a host of novel research approaches and programs to campus. Find here short profiles of no less that eight new professors, three joint appointments, and our most recent Moore Scholar. President Jean-Lou Chameau has also joined the EAS faculty as Professor of Civil Engineering and Environmental Science and Engineering—while we haven't caught him in the lab yet, he has been spotted recently with a shovel and a hard hat breaking ground!

New Faculty

John O. Dabiri: Assistant Professor of Aeronautics and Bioengineering

John O. Dabiri's interests are in the mechanics and dynamics of biological flows in general and biological propulsion in particular. Experimental methods and physical models are implemented in applications including aquatic locomotion, fluid dynamic energy conversion, and cardiac flow diagnostics. A current paradigm for his research is the study of jellyfish as a model system for fluid dynamic and behavioral (e.g., sensing and control) aspects of biological propulsion. In addition, the concept of optimal vortex formation is being generalized with the aim of discovering underlying design principles in biological and bio-inspired propulsion systems.

Dabiri received BSE degree in Mechanical and Aerospace Engineering from Princeton University (2001) and an MS degree in Aeronautics from Caltech in 2003 as a National Defense Science and Engineering Graduate Fellow. He received a PhD in Bioengineering from Caltech in 2005 as a Betty and Gordon Moore Fellow.

Chiara Daraio: Assistant Professor of Aeronautics and Applied Physics

Chiara Daraio's interests reside at the interface of materials science, condensed matter physics, and solid mechanics, particularly in the design, development, and testing of multi-scale metamaterials; phononic crystals; responsive soft matter; tunable acoustics; highly nonlinear solitary waves; mechanical and electronic properties of nano and biomaterials; advanced characterization of materials (high resolution TEM, in-situ analysis, FIB, AFM); synthesis, fabrication and assembly of nanomaterials and composite nanostructures.

Daraio received her Laurea degree (equivalent to a master's degree) in Mechanical Engineering from the Università di Ancona, Università Politecnica delle Marche, Ancona, Italy (2001). She received MS (2003) and PhD degrees (2006) in Materials Science and Engineering from the University of California, San Diego. She has been a guest researcher at the Lawrence Berkeley National Laboratory, National Center for Electron Microscopy since 2003 and is a recipient of the gold Materials Research Society Graduate Student Award (2005).

Chin-Lin Guo: Assistant Professor of Bioengineering and Applied Physics

Chin-Lin Guo investigates cellular mechanisms of self-organization in biological systems, particularly the biomechanics that enhance and stabilize spatio-temporal control, where collective locomotion usually leads to integrated global behaviors. A current project investigates how a single cell polarizes along a unique axis, with a focus on cytoskeleton-mediated processes. He is also interested in the transport mechanism for multi-cell group motion, which appears in embryogenesis, tissue development, and wound healing. His lab plans to combine techniques of advanced optics, clean-room fabrication, and molecular biology to identify these mechanisms. Theoretical models using statistical mechanics and nonlinear dynamics combined with experimental results are also in progress.

Chin-Lin Guo received his MD in 1994 from the Medical School of the National Taiwan University in Taipei and an MS degree in Electrical Engineering in 1996 from the National Taiwan University. After earning a PhD in Physics (2001) from the University of California, San Diego as a Burroughs Wellcome graduate fellow, he visited the

Molecular and Cell Biology Department at Harvard University from 2002 to 2006 as a Helen Hay Whitney postdoctoral fellow.

Tracey C. Ho: Assistant Professor of Electrical Engineering and Computer Science

Tracey Ho's research interests are at the intersection of information theory, networking, and machine learning. She is particularly interested in the theoretical and practical implications of generalizing network behavior from routing/forwarding to network coding. Her previous and ongoing work considers routing, compression, reliability, coordination, and security in distributed network operation.

Ho received SB and MEng degrees in electrical engineering (1999) and a PhD in electrical engineering and computer science (2004) from the Massachusetts Institute of Technology. She has done postdoctoral work at the University of Illinois at Urbana-Champaign and Lucent's Bell Labs.

Swaminathan Krishnan: Assistant Professor of Civil Engineering

Swaminathan Krishnan's areas of interest are structural engineering, computational mechanics, earthquake engineering, and computational seismology. He received his BS (1992) from the Indian Institute of Technology, Madras, his MS (1994) from Rice University, Houston, and his PhD (2004) from Caltech. Between his MS and PhD degrees he worked in the structural engineering industry designing tall buildings in Indonesia, South Korea, and Taiwan. Following his PhD he pursued post-doctoral research at the Seismological Laboratory at Caltech, collaborating with seismologists on the end-to-end simulation of a large San Andreas fault earthquake and the resulting damage to tall buildings in southern California. His future research will focus on developing nonlinear analysis techniques for the accurate simulation of damage in various types of structural systems, plugging the current deficiencies in end-to-end simulations by incorporating uncertainty, soil-structure interaction, and economic analysis, as well as simulating broadband ground motion which requires a probabilistic approach. One of his core missions is to enable nonlinear analysis of structures to be adopted in design by practicing structural engineers through the development of user-friendly software accessible over the internet.

Beverley J. McKeon: Assistant Professor of Aeronautics

Beverley McKeon's research interests lie in the manipulation of steady and unsteady wall-bounded flows, both as a means for performance enhancement (for example in terms of drag or noise reduction or the replacement of traditional control surfaces) and as a diagnostic tool to investigate fundamental flow physics. Techniques include the application of modern materials and microfabrication techniques to the development of "smart" surfaces that can influence flow through local morphing on a range of scales, and the application of control-theoretic tools to describe canonical and practical flows. Thus the research is situated at the intersection of fluid dynamics, solid mechanics, and control in order to address questions of fundamental interest and with application to the aerospace industry.

McKeon received BA and MEng degrees from the University of Cambridge in 1996, before traveling to Princeton University on Fulbright and Guggenheim Scholarships. There she received an MA (1999) and a PhD (2003) in Mechanical and Aerospace Engineering. She returned to the U.K. as a postdoctoral research associate working in flow control in the Department of Aeronautics at Imperial College London, and subsequently as a Royal Society Dorothy Hodgkin Fellow, before joining Caltech.

Sandra M. Troian: Professor of Applied Physics, Aeronautics, and Mechanical Engineering

Sandra Troian's research interests are in high-resolution lithography by microscale contact printing; microfluidic delivery systems using micropatterned thermocapillary flow; boundary conditions for liquid on solid flows; rivulet instabilities in driven spreading films; onset and evolution of digitated structures in spreading surfactant films; and slip behavior and foam stabilization in polymer-surfactant films.

Prior to joining Caltech, Troian was a Professor of Chemical Engineering at Princeton University, and an affiliated faculty member in the Departments of Physics, Mechanical and Aerospace Engineering, and Applied and Computational Mathematics.

Troian received her BA in Physics from Harvard University in 1980, a MS in Physics at Cornell University in 1984, and her PhD in Physics from Cornell University in 1987.

Axel van de Walle: Assistant Professor of Materials Science

Axel van de Walle's interests center on designing and employing software tools constituting a so-called "virtual laboratory," where materials can be discovered, optimized, and characterized through automated high-throughput computational techniques. He has used these tools in a number of technological applications, including precipitation-hardened super alloys, multicomponent semiconductors, lead-free solders, and ion conductors for fuel cells. These tools also enable the calculations of phase diagrams as well as material properties such as diffusion coefficients, interfacial and surface energies, and electronic and phonon excitation spectra.

Before his arrival at Caltech, van de Walle was a Senior Research Associate at Northwestern University. He received his BEng from the École Polytechnique de Montréal (1995) and his PhD in Materials Science and Engineering from the Massachusetts Institute of Technology (2000).

Joint Appointments

John F. Brady: Chevron Professor of Chemical Engineering and Professor of Mechanical Engineering

John F. Brady received his BS in chemical engineering from the University of Pennsylvania in 1975 and spent the next year at Cambridge University as a Churchill Scholar. He received both an MS and a PhD in chemical engineering from Stanford University, the latter in 1981. Following a postdoctoral year at the Ecole Superiéure de Physique et de Chimie Industrielles, he joined the Chemical Engineering department at MIT. Brady moved to Caltech in 1985.

Brady's research interests are in the mechanical and transport properties of two-phase materials, especially complex fluids such as biological liquids, colloid dispersions, suspensions, and porous media. His research takes a multilevel approach and combines elements of statistical and continuum mechanics to understand how macroscopic behavior emerges from microscale physics. He is particularly noted for the invention of the Stokesian Dynamics technique for simulating the behavior of particles dispersed in a viscous fluid under a wide range of conditions.

Brady has been recognized for his work by many awards, including a Presidential Young Investigator Award, a Camille and Henry Dreyfus Teacher-Scholar Award, the ASEE Curtis W. McGraw Research Award, and the Corrsin and Batchelor lectureships in fluid mechanics. He is a fellow of the American Physical Society and a member of the National Academy of Engineering.

James P. Eisenstein: Frank J. Roshek Professor of Physics and Applied Physics

James P. Eisenstein's research in experimental condensed matter physics focuses on the emergent behavior of large numbers of interacting electrons confined to move in two dimensions. In recent years, he and his students and postdocs have discovered a variety of new phases of electronic matter, including the long-sought Bose-Einstein condensate of excitons.

Eisenstein received an AB degree from Oberlin College in Physics and Mathematics in 1974, a PhD from the University of California, Berkeley in Physics in 1980, and

was a member of the Technical Staff of AT&T Bell Laboratories from 1983 to 1996. He joined Caltech in 1996.

Scott E. Fraser: Anna L. Rosen Professor of Biology and Professor of Bioengineering

Scott E. Fraser has a long-standing interest in the imaging and molecular analysis of intact biological systems, and has been active in developing new technologies for novel assays. He has been the Anna L. Rosen Professor of Biology and Director of the Biological Imaging Center at the Beckman Institute since 1991, and the Director of the Caltech Brain Imaging Center since 2002. Before coming to Caltech, he served on the faculty and as the Chair of the Department of Physiology and Biophysics at the University of California, Irvine.

Fraser has been active in the advanced training of interdisciplinary students and post-doctoral fellows, serving as the co-director of the Marine Biological Lab's Embryology Course (with Professor Marianne Bronner-Fraser) and the co-director of Caltech's Initiative in Computational Molecular Biology (with Professor Michael Roukes). Fraser is involved in many professional societies including the American Association for the Advancement of Science; the Society for Developmental Biology; the Society for Neuroscience; the Biophysical Society; the Society of Photo-Optical Instrumentation Engineers; and the American Society for Cell Biology.

He is editor of *Developmental Biology*, and serves on the editorial boards for *NeuroImage*, *Molecular Imaging*, and *Development*. He has earned several awards for teaching and mentoring, as well as the McKnight Scholar Award and the Marcus Singer Medal. He is a fellow of the American Association for the Advancement of Science and of the European Academy of Science. Recent awards include the R&D100 Prize and the NASA Space Act Prize for the invention of new microscope techniques. Fraser earned his BS with honors in Physics from Harvey Mudd College and his PhD (1979) in Biophysics with Distinction from Johns Hopkins University.

Moore Distinguished Scholar

Krishna V. Palem: Georgia Institute of Technology

Krishna V. Palem is Professor of Electrical and Computer Engineering and Professor of Computer Science at the Georgia Institute of Technology. He is a leader in embedded systems research, and founding director of CREST, the Center for Research in Embedded Systems and Technology. The research mission of CREST is to develop compiler-centric software and hardware/software co-design to aid the programmer to rapidly prototype embedded applications.

Palem has played an active role in enabling a community of research in embedded and hybrid systems internationally through invited and keynote lectures, conference organization and participation as well as editorial contributions to journals. He serves on the editorial board of the *ACM Transactions on Embedded Computing Systems*. With Guang Gao, he started the Compilers, Architectures and Synthesis for Embedded Systems (CASES) workshop series in 1998. Since then, this workshop has blossomed into a thriving international conference sponsored by ACM SIGs.

From 1986 to 1994, Palem was a member of the IBM T. J. Watson Research Center. He was a Schonbrunn visiting professor at the Hebrew University of Jerusalem, Israel, where he was recognized for excellence in teaching, and has held visiting positions at the National University and Nanyang Technological University of Singapore. He is a fellow of the ACM and the IEEE.