

**MONDAY
AUGUST 13, 2007**

**Hamerschlag Hall
Room 1112**

**3:00 p.m.
Refreshments—2:30 p.m.**

DR. Chang-Jin “CJ” Kim

**Professor UCLA
Micro- and Nano-Manufacturing Lab; California
NanoSystems Institute
Mechanical and Aerospace Engineering
Department**



Professor CJ Kim received the Ph.D. degree in mechanical engineering from the University of California at Berkeley in 1991 and joined the faculty at UCLA in 1993. Directing the Micro- and Nano-Manufacturing Laboratory, his research is in MEMS and Nanotechnology, including the design and fabrication of micro/nano structures, actuators and systems, with a focus on the use of surface tension. The recipient of the TRW Outstanding Young Teacher Award, NSF CAREER Award, ALA Achievement Award, Prof. Kim has served on numerous technical program committees and government panels in MEMS and nanotechnology. He is currently chairing the Devices and Systems Committee of the ASME Nanotechnology Institute, and serving as a Subject Editor for the IEEE/ASME Journal of MEMS, on Editorial Advisory Board for IEEJ Transactions on Electrical and Electronic Engineering, and on National Academies Panel on Benchmarking the Research Competitiveness of the US in Mechanical Engineering.

ECE Seminar Hosts:

Radu Marculescu,
radum@ece.cmu.edu
Gary Fedder,
fedder@ece.cmu.edu

Digital Microfluidics: Playing with Droplets on Chip

Digital microfluidics is a new class of microfluidics technology, where fluids are handled in discrete volumes rather than continuous flows. Liquid droplets can be moved by various actuation methods, including thermal, surface wave, electrostatic, dielectrophoretic, and electrowetting, the last being the most popular. A common feature of the droplet-driving schemes is that the actuations are local. Since no pressure is needed, digital microfluidic systems can be built without microchannels, pressure sources (e.g., micropumps) or regulatory elements (e.g., microvalves), greatly simplifying the devices and systems. Our current emphasis on digital microfluidics is to build a platform for lab-on-a-chip by the microactuation mechanism of electrowetting-on-dielectric (EWOD). Demonstrated to manipulate aqueous droplets in the air and in oil, EWOD-based microfluidics development has accomplished many physical functionalities: creating, dividing, and merging droplets; mixing different droplets; separating and concentrating particles in a droplet; generating precise droplet volumes on chip by real-time feedback control; and printing such droplets. As a biochemical application example of the EWOD chip, we demonstrate on-chip sample processing for MALDI Mass Spectrometry. To demonstrate the simplicity that EWOD digital microfluidics allows for system development, on the other hand, we showcase a stand-alone handheld prototype system complete with a battery pack. With the ability to create EWOD chips capable of manipulating multiple droplets on a two-dimensional grid array and to build an entire system on a printed circuit board, a complete handheld lab-on-a-chip system seems within the horizon.