



# 2009 Mechanical Engineering Distinguished Seminar Series



The Department of Mechanical Engineering is pleased to host



## Metin Sitti

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## Miniature Mobile Robots Down to Micron Scale

October 2, 2009 | DEWALT Seminar Room, 2164 Glenn Martin Hall | 2:00 pm

**Abstract:** Miniature mobile robots have the unique capability of accessing to small spaces and scales directly. Due to their small size and small-scale physics and dynamics, they could be agile and portable, and could be inexpensive and in large numbers if they are mass-produced. Different scale miniature robots with various locomotion capabilities are presented in this talk. These robots have applications in the fields of mobile sensor networks, environmental monitoring, health-care, inspection, space, security, entertainment, and education. First, as palm-size and centimeter scale robots, climbing robots using gecko foot-hairs inspired micro/nano-fiber adhesives as their repeatable and power efficient attachment materials are proposed. Polymer elastomer micro-fiber arrays with angled and mushroom shaped tip endings and nanoscale and molecular scale polymer fibers on top of the micro-fiber tip endings are demonstrated. These synthetic adhesives are as strong as biological gecko foot-hairs on smooth surfaces. Various climbing robot prototypes using these adhesives show the feasibility of fibrillar adhesives based friction and adhesion enhancement on smooth and micro/nanoscale rough surfaces. Next, going down to tens or hundreds of micron scale robots, significant challenges are on-board actuation principles and power sources. As two alternative approaches, first, external powering and actuation are used to move permanent magnet 100 micron scale robot bodies on planar surfaces in air or in liquid in 2-D. As the next approach, a hybrid (biotic/abiotic) actuation principle is used to propel micron scale robotic bodies in liquid by harvesting the flagellar propulsion of attached bacteria and the chemical energy in the environment.

**Biography:** Metin Sitti received his BSc and MSc in electrical and electronics engineering from Bogazici University, Istanbul, Turkey, in 1992 and 1994, respectively, and his PhD in electrical engineering from the University of Tokyo in 1999. Sitti is currently an associate professor in the Department of Mechanical Engineering and Robotics Institute at Carnegie Mellon University. His research interests include miniature mobile robots, bio-inspired micro/nanosystems, and micro/nanoscale manipulation and manufacturing systems. He has been appointed as the Adamson Career Faculty Fellow in 2007. He received the National Science Foundation CAREER award in 2005. Sitti is the Vice President of the Technical Activities in the IEEE Nanotechnology Council for 2008-2010, and the co-editor-in-chief of *Journal of Micro/Nano-Mechatronics* and an associate editor for the *IEEE Transactions on Robotics*.

For more information, please visit: [www.enme.umd.edu](http://www.enme.umd.edu)

Dr. Sitti will be hosted by Assistant Professor Sarah Bergbreiter of Mechanical Engineering