BILKENT UNIVERSITY

unam - INSTITUTE of MATERIALS SCIENCE & NANOTECHNOLOGY

FACULTY OF SCIENCE

MATERIALS SCIENCE and NANOTECHNOLOGY GRADUATE PROGRAM SEMINAR

"SOLAR TILES (STILEs): PERVASIVE, CONCENTRATED SOLAR POWER HARVESTING USING PORTABLE, SELF-POWERED, WIRELESS, THIN-PROFILE HELIOSTATS"

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Conventional, utility-scale, concentrated solar power (CSP) plants use large-area heliostats, parabolic troughs, or dish collectors that are not only heavy and bulky, but also require significant labor for installation, and maintenance infrastructure. Since these large-area structures require large clearance over the ground surface to track the sun, their form factors are not suitable for low-profile, roof-mountable systems. As such, they have not found much use beyond utility-scale solar power plants that are manufactured in deserts or vast open plains. Photovoltaic systems and flat-plate solar collectors on the other hand, have dominated the roof-top, residential/commercial installations with their low-profile, modular structure, and ease of installation.

Addressing the above issues of traditional, bulky CSP collectors, I will introduce the Solar TILE (STILE) technology, which presents a modular, scalable, and portable approach toheliostats in tower-based central receiver systems. This is achieved by using low-profile, light-weight, sun-tracking, millimeter-to-centimeter-scale mirror arrays that can be wirelessly controlled to reflect the incident solar energy to a central receiver. STILE technology enables concentrated solar power harvesting on a given surface with form factor and weight per unit area comparable to those of ceramic tiles used on walls/floors or that of PV modules. Self-powered operation by integrated solar cells, wireless operation, and weather-proof enclosure of moving parts help STILE technology promise lower installation and maintenance costs than PV approaches, while enabling novel beamredirection applications over large surfaces. As the STILEs are made of mostly plastic, which costs at least an order of magnitude less than solar grade silicon, associated material costs could potentially be much cheaper than silicon PV cells.

After a description of the STILE technology and a discussion of mirror scaling, I will describe a STILE prototype with dimensions 33cm X 33cm X 6.4cm and detail its wireless operation. 2-D optical ray tracing simulations and novel application areas for STILEs will be mentioned along with experimental results performed at a residential building in Ithaca, NY, USA.

Dr. Serhan Ardanuç received his B.S. degree in electrical engineering from Middle East Technical University, Ankara, Türkiye, in 2001. In the same year, he started his Ph.D. studies in the School of Electrical and Computer Engineering at Cornell University. In 2002, he joined SonicMEMS Laboratory, where he completed his Ph.D. studies in 2010 with a minor in theoretical and applied mechanics under the supervision of Prof. Amit Lal. Towards the end of his Ph.D. and later as a postdoctoral research associate, Serhan has been actively involved in the disclosure and development of the STILE technology. During the summer of 2006, he worked on failure analysis of micro-inkjet devices at Xerox Research Center in Webster, NY. His research interests include array-based systems formed by spatial repetition of identical elements, design/testing of micrometer to centimeter scale, wireless, reflector platforms for large area beam-steering and solar concentration applications, mixed-signal circuit design, finite element/behavioral modeling inmicrosystems, and ultrasonic applications of microelectromechanical systems..

Date : October 7, 2010 (Thursday)
Time : 15:40
Place : Faculty of Science Building, A Block, Seminar Room (SA 240)

Tea will be served after the seminar