NU Mechanical and Industrial Engineering Colloquium Series – Spring 07

TUESDAY Jan 30, Egan Research Center 306

PROGRAM

10:45 - 11:00 a.m. Tea, Coffee and Treats
11:00 - 11:45 p.m. Lecture (typical)
11:45 - 12:00 p.m. Q&A and Discussion

ABSTRACT

A review of ongoing research projects at the Photo-Acoustic Research (PAR) Laboratory, founded by the speaker in 2001, will be presented and the future directions regarding the areas of these projects will be discussed. The specific studies within the research program, featuring analytical, computational and experimental components, are as follows:

(*i*) Mechanics and Testing/Characterization of Drug Tablets (*millimeter-scale*): A drug tablet is a consumable, mechanical delivery device and its mechanical properties and integrity often affect its therapeutic functions. Air-coupled acoustic excitation of vibrational modes of a tablet and the interferometric detection of its motion as well as a computational scheme are employed to determine defect state and mechanical properties of the core and coating materials of the tablet, both of a particular interest in the pharmaceuticals industry;

(*ii*) Mechanical Characterization of Microspheres, Cantilever Beams, and Rotational Disks (*micrometer-scale*): As the complexity and functionality of micro-scale mechanical systems (e.g. MEMS, sensors and transducers) constantly accelerate, the need for analysis, testing and characterization techniques for these structures has been increasing. A set of non-contact techniques developed for micro-scale structures will be presented and their roles in the development of MEMS and biosensors will be discussed;

(*iii*) Nanoparticle Adhesion and Removal (*nanometer-scale*): Laser induced plasma (LIP) shockwaves, as a means of exerting strong pressure fields on a surface in a non-contact manner, can be utilized for adhesion characterization and precision removal of nanoparticles from substrates. In recent years, cleaning of patterned wafers and extreme ultraviolet lithography (EUVL) photomasks has been receiving close attention. Based on shock-tubes, a recent LIP technique developed in the PAR laboratory for increasing the effectiveness and stability of the LIP approach will be presented. Its potential in sub-65 *nm* damage-free cleaning will be discussed.

SEMINAR TITLE

"Acoustics and Vibration of Mechanical Systems in the Range of Millimeter to Nanometer-scale"

SEMINAR SPEAKER

Professor Cetin Cetinkaya
Photo-Acoustics Research Laboratory
Department of Mechanical & Aeronautical Engineering
Clarkson University
Potsdam, NY

BIOGRAPHIC PROFILE

Dr. Cetinkaya obtained his M.S. and Ph.D. degrees from University of Illinois at Urbana-Champaign in 1991 and 1995, respectively, following his B.S. degree from Istanbul Technical University. All his degrees are in Aerospace Engineering. His Ph.D. thesis research was on elastic wave propagation in layered structures.

Dr. Cetinkaya is currently an associate professor of mechanical engineering at Clarkson University. Prior to joining the Clarkson in 1997, he worked for Wolfram Research Member of the Research and Development Staff from 1995 to 1997. During this period, he also served as an Adjunct Assistant Professor in Dept. of Mechanical & Industrial Engineering at the UIUC.

Dr. Cetinkaya founded the Photo-Acoustic Research (PAR) Laboratory in 2001. His current research interests are in the areas of characterization/testing/analysis of small-scale and MEMS structures, adhesion and removal of nanoparticles, laser acoustic wave propagation, and specialized sensors and algorithms for non-contact/non-invasive process monitoring. These externally funded projects in the PAR Laboratory focus on a set of critical applications in semiconductors, nanotechnology, and MEMS sensors as well as pharmaceuticals manufacturing. The research projects have been funded by various federal, state and industrial sources: NSF, Intel and International SEMATECH, Praxair/Electronic, U.S. Army Research Office and Wyeth.

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