Joint Technical Seminar Program
IEEE Oregon CPMT/CAS Chapter
(in cooperation with the SMTA, IMAPS, IPC & EMA)
presents

Krishnendu Chakrabarty
Distinguished Lecturer of the IEEE Circuits and Systems Society
Professor of Electrical and Computer Engineering
Duke University

Thursday, April 11, 2013, 6:00-7:30 pm
PCC Willow Creek Center, Room 103
241 SW Edgeway Drive (near SW 185th and Baseline Road)
Beaverton, OR 97006
Directions: http://www.pcc.edu/about/locations/willow-creek/

Information: https://meetings.vtools.ieee.org/meeting_view/list_meeting/17247
Registration: https://meetings.vtools.ieee.org/meeting_registration/register/17247
(Registration is free, but helps in planning the refreshments)


Agenda:
6:00pm Refreshments and social
6:30pm (1) “Test and Design-for-Testability Solutions for 3D Integrated Circuits”
7:30pm (2) “Digital Microfluidic Biochips”
8.00pm Adjourn

Abstracts

Test and Design-for-Testability Solutions for 3D Integrated Circuits

Despite the numerous benefits offered by 3D integration, testing remains a major obstacle that hinders its widespread adoption. Test techniques and design-for-testability (DfT) solutions for 3D ICs have remained largely unexplored in the research community, even though experts in industry have identified a number of hard problems related to the lack of probe access for wafers, test access to modules in stacked wafers/dies, thermal concerns, and new defects arising from unique processing steps. In this talk, the speaker will present a number of testing and DfT challenges, and describe some of the solutions being advocated for these challenges. The presentation will focus on the following hot topics:

- TSV defects and on-die defects induced by TSV processing;
- Test generation for TSV-induced stress;
- Pre-bond testing of TSVs and die logic, recent advances in probing, non-invasive test using DfT;
- Post-bond testing and DfT innovations related to the optimization of die wrappers, test scheduling, and access to dies and inter-die interconnects;
- Fault diagnosis and TSV repair.
Digital Microfluidic Biochips:
Towards Functional Diversity, More than Moore, and Cyberphysical Integration

Advances in droplet-based "digital" microfluidics have led to the emergence of biochip devices for automating laboratory procedures in biochemistry and molecular biology. These devices enable the precise control of nanoliter-volume droplets of biochemical samples and reagents. Therefore, integrated circuit (IC) technology can be used to transport and transport "chemical payload" in the form of micro/nanofluidic droplets. As a result, non-traditional biomedical applications and markets (e.g., high-throughput DNA sequencing, portable and point-of-care clinical diagnostics, protein crystallization for drug discovery), and fundamentally new uses are opening up for ICs and systems. However, continued growth depends on advances in chip integration and design-automation tools. Design-automation tools are needed to ensure that biochips are as versatile as the macro-labs that they are intended to replace, and researchers can thereby envision an automated design flow for biochips, in the same way as design automation revolutionized IC design in the 80s and 90s. Biochip users (e.g., chemists, nurses, doctors and clinicians) and the biotech/pharmaceutical industry will adapt more easily to new technology if appropriate design tools and in-system automation methods are made available.

This lecture will first provide an overview of market drivers such as immunoassays, DNA sequencing, clinical chemistry, etc., and electrowetting-based digital microfluidic biochips. The audience will next learn about CAD, design-for-testability, and reconfiguration aspects of digital microfluidic biochips. Synthesis tools will be described to map assay protocols from the lab bench to a droplet-based microfluidic platform and generate an optimized schedule of bioassay operations, the binding of assay operations to functional units, and the layout and droplet-flow paths for the biochip. The role of the digital microfluidic platform as a “programmable and reconfigurable processor” for biochemical applications will be highlighted. Finally, the speaker will describe dynamic adaptation of bioassays through cyberphysical system integration sensor-driven on-chip error recovery.

Speaker Biography

Krishnendu Chakrabarty received the B. Tech. degree from the Indian Institute of Technology, Kharagpur, in 1990, and the M.S.E. and Ph.D. degrees from the University of Michigan, Ann Arbor, in 1992 and 1995, respectively. He is now Professor of Electrical and Computer Engineering at Duke University. He is also a Chair Professor at Tsinghua University, Beijing, China, a Visiting Chair Professor at National Cheng Kung University in Taiwan, and a Guest Professor at University of Bremen in Germany. Prof. Chakrabarty is a recipient of the National Science Foundation Early Faculty (CAREER) award, the Office of Naval Research Young Investigator award, the Humboldt Research Fellowship from the Alexander von Humboldt Foundation, Germany, and several best papers awards at IEEE conferences.

Prof. Chakrabarty’s current research projects include: testing and design-for-testability of integrated circuits; digital microfluidics, biochips, and cyberphysical systems; optimization of digital print and enterprise systems. He has authored 12 books on these topics (with two more books in press), published over 430 papers in journals and refereed conference proceedings, and given over 190 invited, keynote, and plenary talks. He has also presented 30 tutorials at major international conferences. Prof. Chakrabarty is a Fellow of IEEE, a Golden Core Member of the IEEE Computer Society, and a Distinguished Engineer of ACM. He holds two US patents and he has several pending patents. He was a 2009 Invitational Fellow of the Japan Society for the Promotion of Science (JSPS). He is a recipient of the 2008 Duke University Graduate School Dean’s Award for excellence in mentoring, and the 2010 Capers and Marion McDonald Award for