SEMI-THERM 33

KEYNOTE   Tuesday March 14, 2017

Ultimately Dense and Efficient Future Computers

Liquid cooling enables an unprecedented density in future computers to a level similar to a human brain. This is mediated by a dense 3D architecture for interconnects, fluid cooling, and power delivery of energetic chemical compounds transported in the same fluid. Vertical integration improves memory proximity and electrochemical power delivery creating valuable space for communication. This strongly improves large system efficiency thereby allowing computers to grow beyond exa-scale. A dense and efficient µServer has been demonstrated as a first milestone along this roadmap. A universal concept is presented showing that volumetric density drives efficiency in information processing irrespective of switch technology and architecture, and can replace the currently slowing Moore's law. By adopting some of the characteristics of the human brain, computers have the potential to become far more compact, efficient, and powerful. And this, in turn, will allow us to take full advantage of cognitive computing – providing our real brains with new sources of support, stimulus, and inspiration.

Bruno Michel received a Ph.D. degree in biochemistry/biophysics from the University of Zurich subsequently joined IBM Research to work on scanning probe microscopy and later on the development of accurate large-area soft lithography. Dr. Michel started the Advanced Micro Integration group to improve thermal interfaces and minaturized convective cooling for processors and concentrated photovoltaic systems. Main current research topics of the Zurich group are microtechnology/microfluidics for nature-inspired minaturized tree-like hierarchical supply networks, 3D packaging, and thermophysics for improved understanding of heat transfer in nanomaterials and structures. Dr. Michel started the energy aware computing initiative at IBM and triggered the Aquasar project to promote improved efficiency and energy re-use in future green datacenters and photovoltaic thermal solar concentrators.

DATA CENTER KEYNOTE   Wednesday, March 15, 2017

A Holistic View of a Fragmented Data Center Industry

SEMI-THERM and AFCOM are excited to have Dr. Sammakia provide the Keynote speech for the Data Center Track at SEMI-THERM 33. Dr. Sammakia's experience spans the full physical scale of IT systems (chip to chiller) and the evolution of the data center from mainframe rooms to today's distributed and cloud computing facilities. Please join us for Dr. Sammakia's unique perspective on how data centers and IT systems have evolved over the decades, the impact of this history on engineering practices and computing performance (with a focus on the Gap between IT and facilities) and where the industry is likely to head into the future.

Dr. Bahgat Sammakia is a Distinguished SUNY Professor and the vice president for research at Binghamton University. Dr. Sammakia has spent much of his research career working to improve thermal management strategies in electronic systems at multiple scales ranging from devices to entire Data Centers. Dr. Sammakia joined the faculty of the Watson School for Engineering and Applied Science in 1998 following a fourteen-year career at IBM where he worked in the area of research and development of organic electronic systems. He has contributed to several books on natural convection heat transfer and is also the principal investigator or co-principal investigator on several cross-disciplinary research projects. Dr. Sammakia received his PhD degree in mechanical engineering from the State University of New York at Buffalo. He was a post doctoral fellow at the University of Pennsylvania from 82 to 84. Dr. Sammakia is a Fellow of the IEEE, the ASME and of the National Academy of Inventors. Dr. Sammakia has over 250 publications in refereed Journals and conference proceedings as well as several books and book chapters related to electronic systems thermal management.

Luncheon Speaker Tuesday, March 14, 2017

Multi-Scale Optimization Strategies for Electronics Thermal Management & Energy Harvesting
Ercan M. Dede

The compact and power-dense nature of advanced electronics is expected to push the limits of traditional thermal management techniques. At the same time, low-grade waste heat represents a tangible source of inefficiency for future electrified systems. Exploiting effective design optimization strategies in the research and development of new cooling and material technologies enables opportunities for increased system performance. Accordingly, gradient-based structural optimization methodologies and their implementation at multiple scales is the focus of this talk. Specifically, electronics thermal management and waste heat recovery are explored as end applications. At the component level, several case studies are presented to illustrate the technical approach for air, single-phase liquid, and two-phase cooling of automotive power electronics. At the material level, thermal composite printed circuit board design for informed heat flow control and energy harvesting is outlined. Through these various examples, multi-scale optimization is revealed to be an essential element in the drive towards novel high performance thermal energy management technologies.

Ercan M. Dede received his B.S. degree and Ph.D. in mechanical engineering from the University of Michigan and an M.S. degree in mechanical engineering from Stanford University. Currently, he is a manager in the Electronics Research Department at the Toyota Research Institute of North America. His group conducts research on advanced vehicle electronics systems including power semiconductors, advanced circuits, packaging, and thermal management technology. He has over 30 issued patents and has published more than 40 articles in archival journals and conference proceedings on topics related to design and structural optimization of thermal, mechanical, and electromagnetic systems.

Luncheon Speaker Wednesday, March 15, 2017
Reducing Earthquake Hazards at Manufacturing Facilities
Guna Selvaduray, Ph.D.

Since the Loma Prieta Earthquake of October 17, 1989 the San Francisco Bay Area has not experienced a major earthquake. This presentation will begin with a brief description of the earthquake threat faced by the urbanized SF Bay Area, with a focus on the fault lines that run through this region. The major part of this presentation will focus on the damage that the industries in the Kansai Region in Japan experienced during the Kobe Earthquake of Jan 17, 1995, and the lessons that were learned from that unfortunate experience. Examples (slides) of damage to buildings and equipment, a summary of the research findings intended to reduce damage and accelerate recovery, and mitigation measures that can be taken ahead of time to reduce damage, especially for production and laboratory equipment will constitute a major part of this presentation.

Dr. Guna Selvaduray earned his M.S. and Ph.D. degrees from Stanford University and his B. Eng. degree from Tokyo Institute of Technology. His research has focused on nonstructural hazard mitigation, hazardous materials problems caused by earthquakes, and protection of building contents and plant equipment from earthquake damage. He has been the recipient of research grants from the National Science Foundation, the Department of the Interior and the California State Government. At San Jose State University, Dr. Selvaduray created the Collaborative for Disaster Mitigation (CDM), a public-private-academic partnership that has focused on implementing hazard mitigation in order to achieve loss reduction.