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Thermal challenges in next generation electronic systems

Yogendra Joshi

Georgia Tech, yogendra.joshi@me.gatech.edu

S V. Garimella

Purdue Univ, sureshg@purdue.edu

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Editorial

Thermal challenges in next generation electronic systems

As electronic products become faster and incorporate greater functionality, they are also shrinking in size and weight, with continuing pressures for cost reduction. Thermal issues are key in electronic product development at all levels of the electronic product hierarchy, from the chip to the ultimate system. Shrinking system sizes are resulting in increasing volumetric heat generation rates and surface heat fluxes in many products. This has resulted in a significant interest in ultra-compact thermal management devices with high heat removal capabilities. Additional thermal management challenges arise as more and more electronic systems are employed in harsh environments, subject to large variations in ambient temperatures and external thermal loads. A synergistic activity is thermal characterization through computations. High-fidelity modeling schemes are being sought, as product development cycles shrink to a period of months in many portable products.

The United Engineering Foundation workshop 'Thermal Challenges in Next Generation Electronic Systems (THERMES)', was held in January 13–16, 2002, in Santa Fe, New Mexico, with support from the US National Science Foundation. The focus was on recent advances in thermal management and characterization schemes, as well as forecasts and analyses of future trends. Three keynote lectures and nine invited talks in selected emerging areas from leading experts in industry and academia were complemented with contributed papers organized into nine technical sessions. Five panel discussions focused on technology and market trends and identification of research challenges.

Discussions engendered by the keynote and invited lectures, panel discussions, and contributed papers as well as informal conversations, pointed to a consensus that the key

needs in thermal management for next generation electronic systems should include considerations of:

- compact high-heat-flux devices;
- chip level non-uniformities;
- holistic view of thermal management;
- autonomic resource management

In addition, the following needs in thermal characterization of electronics were emphasized:

- computationally efficient multi-scale methods;
- new considerations for data centers;
- transients

Selected papers from the conference have been reviewed and are appearing in this special issue of the *Microelectronics Journal* and a companion issue of *IEEE Transactions on Components and Packaging Technologies*. We are grateful to all the contributors and reviewers.

Yogendra K. Joshi

*G.W. Woodruff School of Mechanical Engineering,
Georgia Institute of Technology,
Atlanta, GA 30332, USA*

E-mail address: yogendra.joshi@me.gatech.edu

Suresh V. Garimella

*Cooling Technologies Research Center, an NSF I/UCRC,
School of Mechanical Engineering, Purdue University,
585 Purdue Mall, West Lafayette, IN 47907-2040,
USA*

E-mail address: sureshg@ecn.purdue.edu