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Designing Reliable Systems with Unreliable Components

edaForum05 Presentation

Technical Session II

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Intel Corporation Designing Reliable Systems with Unreliable Components

Abstract

VLSI system performance increased by five orders of magnitude in the last three decades, made possible by continued technology scaling. This treadmill will continue, providing integration capacity of billions of transistors; however, power, energy, variability, and reliability will be the barriers.

As technology scales, variability will continue to become worse. Random dopant fluctuations in the transistor channel and subwavelength lithography will yield static variations. Increased power densities will stress power grids creating dynamic supply voltage and temperature variations, thereby affecting circuit performance and leakage power. Since the behavior of the fabricated design will be different from what was intended, the effect of these static and dynamic variations will look like inherent unreliability in the design.

Soft error rates due to cosmic rays will continue to get worse, and the total state bits in a design will also double every two years, increasing intermittent error rate of a design by almost two orders of magnitude. As transistors become even smaller, degradation due to aging will become worse reducing transistor current over time and impacting performance of the design.

In this presentation these effects will be discussed and research in microarchitecture, design, and testing, for designing with billions of unreliable components to yield reliable systems will be proposed.

Biography



Shekhar Borkar Director of Microprocessor Research Intel Corporation

He graduated with MS in Physics from University of Bombay, MSEE from University of Notre Dame in 1981, joined Intel Corporation. He worked on the 8051 family of microcontrollers, the iWarp multicomputer project, and subsequently on Intel's supercomputers. He is an Intel Fellow and director of Microprocessor Research. His research interests are high performance and low power digital circuits, and high-speed signaling. Shekhar is an adjunct faculty member at Oregon Graduate Institute, and teaches VLSI design.

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