Interconnect Reliability Analysis in Conventional and 3D Integrated Circuits

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Abstract:
Total on-chip interconnect length has been increasing exponentially with technology scaling. Consequently, interconnect-driven design is an emerging trend in state-of-the-art integrated circuits. Cu-based interconnect technology is expected to meet some of the challenges of technology scaling. However, Cu interconnects still pose a reliability concern due to electromigration-induced failure over time. In this talk, I will present a new reliability CAD tool (SysRel) and methodologies developed at MIT for thermal-aware reliability analysis with either Al or Cu metallization in conventional and three-dimensional (3D) integrated circuits. SysRel utilizes a tree-based hierarchical analysis that sufficiently captures the differences between electromigration behavior in Al and Cu metallizations. The flow first identifies electromigration critical nets or "mortal" trees, applies a default model to estimate the lifetimes of individual trees, and then produces a set of full-chip metrics based on stochastic analysis using the desired lifetime of the circuit. Simulation results with several circuit layouts will be presented. Future reliability issues with Cu/low-k technology and non-blocking (barrier-less vias) will be explored.

Biography:
Syed M. Alam got his B.S. in electrical engineering from the University of Texas at Austin in May 1999, S. M. and Ph.D. in electrical engineering and computer science from Massachusetts Institute of Technology in June 2001 and September 2004, respectively. He is currently with Freescale Semiconductor working on signal integrity and interconnect noise analysis. His research interests include 3D Integrated Circuits, reliability CAD, thermal modeling/analysis in ICs, and interconnect analysis. He has several publications and invited talks including a tutorial presentation on interconnect reliability at ICCAD. He interned at IBM T. J. Watson Research Center designing a test chip in 3D IC technology. Dr. Alam is a full member of Sigma Xi Scientific Research Society and a member of IEEE, Tau Beta Pi, and Eta Kappa Nu.