Uncovering Circuit Reliability Effects Using Dedicated On-Chip Monitors

Chris H. Kim  
Department of Electrical and Computing Engineering  
University of Minnesota – Twin Cities  
chriskim@umn.edu  
www.umn.edu/~chriskim/

Abstract:

Device aging mechanisms such as Negative Bias Temperature Instability (NBTI), Hot Carrier Injection (HCI) and Time Dependent Dielectric Breakdown (TDDB) have emerged as serious problems undermining the long term reliability of high performance systems. In this presentation, we will review a number of unique test chip designs pursued by circuit designers that demonstrate the benefits of utilizing on-chip logic and a simple test interface to automate circuit aging experiments. This new class of compact on-chip sensors, called "silicon odometers", can reveal important aspects of circuit aging that would otherwise be impossible to measure, and can lead us down the path to real-time aging compensation in future processors.

Short bio:

Chris H. Kim received his B.S. and M.S. degrees from Seoul National University and a Ph.D. degree from Purdue University. He spent a year at Intel Corporation where he performed research on variation-tolerant circuits, on-die leakage sensor design and crosstalk noise analysis. He joined the electrical and computer engineering faculty at the University of Minnesota in 2004. His research interests include digital, mixed-signal, and memory circuit design for silicon and non-silicon (=flextronics and spintronics) technologies.