Editorial to Special Issue on Reliable Computing

I am pleased to present you with this special issue of the ACM Journal on Emerging Technologies in Computing, which consists of a set of papers from the 2006 ACM Computing Frontiers Conference (CF'06) plus a particularly novel paper from the 2006 Symposium on Architectural Support for Programming Languages and Operating Systems. The unifying theme is Reliable Computing, but individual topics range from a magnetic bus technology to aspects of self-healing, self-configuring, and self-replicating systems.

The first article, The Spin-wave Nano-Scale Reconfigurable Mesh and the Labeling Problem by Eshaghian-Wilner, Khitun, Navab, and Wang presents spin-wave buses composing a highly parallel, nanoscale, reconfigurable communication mesh. The high degree of parallelism combined with reconfigurability makes the technology well suited for implementing fault-tolerant communication algorithms.

The next set of articles come from a special session at CF'06 on Reliable Computing. This session looked at novel ways of using nature to help us cope with our growing complexity and also help with fault tolerance. The article Design for Dependability in Emerging Technologies by Prodan, Udrescu, Boncalo, and Vladutiu provides an overview of the technologies explicated in the session, and thus serves as a nice introduction to the range of approaches taken by researchers in this global community. Evolving Dependability by Tyrrell and Greensted takes a high-level view of the dependability problem, elucidating how bio-inspired systems embody phylogeny (evolution), ontogeny (reproduction), and epigenesis (adaptation through learning and responding to change). The FPGA systems explored focus on exploiting ontogenetic and phylogenetic processes. The next article, Evolutionary Functional Recovery in Virtual Reconfigurable Circuits by Sekanina addresses reconfigurability for reliability at the circuit level, exploiting phylogenetic processes. Finally, Self-Replication for Reliability: Bio-Inspired Hardware and the Embryonics Project by Tempesti, Mange, Mudry, Rossier, and Stauffer describes an FPGA-based system that exploits ontogenesis, self-generating a system through replication.

The final article, A Self-Organizing Defect Tolerant SIMD Architecture by Patwardhan, Dwyer, and Lebeck describes a system targeted for nanotechnologies or CMOS processes with extremely small feature sizes where the underlying substrate will inevitably contain many defects for which we must compensate at the circuit or architectural levels (or both). The architecture described is a system that self-organizes a large number of limited capability nodes.

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I chose these articles for their novelty and potential to encourage scholarly discourse about the systems and technologies they describe. I learned from each. I hope you find this issue both educational and enjoyable.

—SALLY A. MCKEE
Cornell University
Guest Editor