**LEARNING-ASSISTED EFFICIENT ERROR DETECTION AND CORRECTION IN REAL-TIME SIGNAL PROCESSING AND CONTROL SYSTEMS**

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*ABSTRACT:* In this research, we focus on the design of analog and digital signal processing circuits and systems that are resilient to errors induced by electrical bugs such as power/ground bounce, interconnect crosstalk, soft errors due to radiation and permanent parametric failures We assume that the electrical bug effects are localized to specific regions of the affected circuits and that the soft error statistics are known. While the analog and digital circuits considered in this research are predominantly linear, we apply some of the concepts developed in this work to nonlinear digital systems as well. We propose to use less than minimum distance codes for implementation of the error/failure detection and diagnosis mechanisms. This allows the use of circuitry that is traditionally only good for error detection, to perform error diagnosis and correction as well. However, a one-time iterative learning process is used for diagnosing the sources of the errors/failures and for determining the most effective way to perform error cancellation/correction when the error source is persistent (this holds well for power/ground bounce and crosstalk induced noise under repeated load conditions). For random soft errors such learning is difficult and error correction is performed using support from hardware based error checking mechanisms. The techniques used for a variety of signal processing and control systems will be demonstrated with real-world examples.

**Abhijit Chatterjee** is a professor in the School of Electrical and Computer Engineering at Georgia Tech and a Fellow of the IEEE. He received his PhD in electrical and computer engineering from the University of Illinois at Urbana-Champaign in 1990. Dr. Chatterjee received the NSF Research Initiation Award in 1993 and the NSF CAREER Award in 1995. He has received six Best Paper Awards and three Best Paper Award nominations. His work on self-healing chips was featured as one of General Electric’s key technical achievements in 1992 and was cited by the Wall Street Journal. In 1995, he was named a Collaborating Partner in NASA’s New Millennium project. In 1996, he received the Outstanding Faculty for Research Award from the Georgia Tech Packaging Research Center, and in 2000, he received the Outstanding Faculty for Technology Transfer Award, also given by the Packaging Research Center. In 2007, his group received the Margarida Jacome Award for work on VIZOR: Virtually Zero Margin Adaptive RF from the Berkeley Gigascale Research Center (GSRC).

Dr. Chatterjee has authored over 400 papers in refereed journals and meetings and has 21 patents. He is a co-founder of Ardext Technologies Inc., a mixed-signal test solutions company and served as chairman and chief scientist from 2000-2002. His research interests include error-resilient signal processing and control systems, mixed-signal/RF/multi-GHz design and test and adaptive real-time systems. He served as the chair of the VLSI Technical Interest Group at Georgia Tech from 2010-2012.