Guest Editor's Introduction

Wunderlich, Hans-Joachim; Zorian, Yervant

IEEE Design & Test 21 May 2018

doi: https://doi.org/10.1109/MDAT.2018.2799806

Abstract: Automotive microelectronics are gaining great impact with the advent of electromobility and self-driving cars. Being a mass market, cost sensitivity is a major concern, while the functional safety, security, stringent run-time requirements and reliable operation are still major challenges. Automotive Reliability and Test (ART) has been the most popular topic at the recent IEEE International Test Conferences, and the ART Workshop 2016 in conjunction with ITC was extremely popular. This special issue of IEEE Design&Test originates from this workshop and deals with the most significant topics in automotive reliability and test.

Guest Editor's Introduction

Hans-Joachim Wunderlich and Yervant Zorian
University of Stuttgart, Germany

Automotive microelectronics form a rapidly increasing mass market which is gaining more and more impact with the advent of electro-mobility and self-driving cars. Being a mass market, cost sensitivity is a major concern, but at the same time functional safety, security, stringent runtime requirements and reliable operation are still major challenges. "Automotive Reliability and Test" has been the most popular topic at the recent IEEE International Test Conferences, and the ART Workshop 2016 in conjunction with ITC was extremely popular. This special issue of Design and Test originates from this workshop and deals with the most urgent topics in automotive reliability and test.

Most papers collected in this issue stem from industry; some are co-authored with academia, and they give insight into the most recent research areas on automotive microelectronics. An essential part is formed by functional safety, fault tolerance and self-checking systems. As an example, triple modular redundancy is an option to satisfy the strict safety requirements for autonomous driving. The first article introduces a solution proposed by ARM Ltd. at CPU core level which minimizes the possible single points of failure. Additional effort is spent to mitigate the fault recovery routines and the assisting infrastructure.

System runtime test and power-on self-test are effective means covering safety critical faults in automotive microelectronics. The second paper is co-authored by researchers from Renesas Electronic Corporation and from Ehime University, Japan, and reuses logic built-in self-test (BIST) and specific test patterns for power-on self-test. The authors suggest a multi-cycle logic BIST technique which avoids fault masking after multiple cycles by sequential observation using a new scan cell structure.

Analyzing the safety of automotive systems at the application level is especially challenging as often only very complex or even incomplete models are available. The authors of the third paper from the University of Illinois combine formal reasoning with simulation data to effectively prove safety or estimate worst case accidents for automotive control systems.

Analog and mixed-signal (AMS) circuitry forms a substantial part of automotive electronics, and their test application time contributes predominantly to the overall test time. The next two papers are co-authored by ON Semiconductor and the Katholieke Universiteit Leuven and cover design-for-test and test generation of AMS cores. The first one presents a low-cost design-for-test technique which allows a high level of parallelism for testing analog cores. In the second paper, the authors present an integrated workflow for design-for-test and test signal generation of mixed-signal circuits. The DfT phase pre-partitions the core under test and allows an efficient automatic generation of test signals.

Automotive systems-on-a-chip contain digital, analog and mixed-signal cores, different types of memories, sensors and many other technologies. For all of them, early life failures have to be excluded to fulfill the high reliability needs of automotive electronics. While burn-in test may be an effective technique it is also a very significant cost factor. The last article is co-authored by ST Microelectronics and the Politecnico di Torino, and presents strategies for stress test parallelization for different structures.

The automotive papers in this special issue cover a wide range of most relevant topic. My special thanks goes to all the authors who submitted their work, and to all the reviewers whose constructive comments helped to improve the articles.