# Table of Contents

Foreword................................................................................................................................................................. x  
Organizing Committee................................................................................................................................................ xi  
Program Committee................................................................................................................................................... xiv  
Steering Committee.................................................................................................................................................... xv  
Reviewers................................................................................................................................................................. xvi  
Acknowledgements..................................................................................................................................................... xviii  
Test Technology Technical Council (TTTC) ............................................................................................................... xix  
Test Technology Educational Program (TTEP) Tutorials......................................................................................... xxii  
Awards......................................................................................................................................................................... xxv  

## Session 1

### Session 1A: Microprocessor Test

- Efficient Array Characterization in the UltraSPARC T2
  - Thomas Ziaja and P.J. Tan
  - Page 3

- Instruction-Level Impact Comparison of RT- vs. Gate-Level Faults in a Modern Microprocessor Controller
  - Michail Maniatakos, Naghmeh Karimi, Chandra Tirumurti, Abhijit Jas and Yiorgos Makris
  - Page 9

- Modeling and Testing Comparison Faults of TCAMs with Asymmetric Cells
  - Yong-Jyun Hu, Yu-Jen Huang and Jin-Fu Li
  - Page 15

### Session 1B: Fault Models

- An Electrical Model for the Fault Simulation of Small Delay Faults Caused by Crosstalk Aggravated Resistive Short Defects
  - N. Houarche, M. Comte, M. Renovell, A. Czutro, P. Engelke, I. Polian and B. Becker
  - Page 21

- Small Delay Fault Model for Intra-Gate Resistive Open Defects
  - Masayuki Arai, Akifumi Suto, Kazuhiko Iwasaki, Katsuyuki Nakano, Michihiro Shintani, Kazumi Hatayama and Takashi Aikyo
  - Page 27

- Defect Detection Differences between Launch-Off-Shift and Launch-Off-Capture in Sense-Amplifier-Based Flip-Flop Testing
  - Haluk Konuk
  - Page 33
Session 2

Session 2A: Robust Design and Fault Tolerance

Soft-Error Hardening Designs of Nanoscale CMOS Latches
Sheng Lin, Yong-Bin Kim and Fabrizio Lombardi

Exploiting Unused Spare Columns to Improve Memory ECC
Rudrajit Datta and Nur A. Touba

An Adaptive-Rate Error Correction Scheme for NAND Flash Memory
Te-Hsuan Chen, Yu-Ying Hsiao, Yu-Tsao Hsing and Cheng-Wen Wu

Session 2B: Delay Fault Testing I

Compact Delay Test Generation with a Realistic Low Cost Fault Coverage Metric
Zheng Wang and Duncan M.H. Walker

Recursive Path Selection for Delay Fault Testing
Jaeyong Chung and Jacob A. Abraham

A Synthesis Method to Alleviate Over-Testing of Delay Faults Based on RTL Don't Care Path Identification
Yuki Yoshikawa, Satoshi Ohtake, Tomoo Inoue and Hideo Fujiwara

Session 3

Session 3A: Debug

Automated Selection of Signals to Observe for Efficient Silicon Debug
Joon-Sung Yang and Nur A. Touba

A New Post-Silicon Debug Approach Based on Suspect Window
Jianliang Gao, Yinhe Han and Xiaowei Li

Automated Debug of Speed Path Failures Using Functional Tests
Richard McLaughlin, Srikanth Venkataraman and Carlston Lim

Session 3B: Delay Fault Testing II

Output Hazard-Free Transition Delay Fault Test Generation
Sreekumar Menon, Adit D. Singh and Vishwani Agrawal

Efficient Scheduling of Path Delay Tests for Latch-Based Circuits
Kun Young Chung and Sandeep K. Gupta

Effective and Efficient Test Pattern Generation for Small Delay Defect
Sandeep Kumar Goel, Narendra Devta-Prasanna and Ritesh P. Turakhia

Session 4

Special Session 4A: Panel: Apprentice - VTS Edition: Season 2
Organizer and Moderator: Kee Sup Kim

Special Session 4B: Panel: DFT and Test Problems from the Trenches
Organizer and Moderator: Haluk Konuk
Session 5

Session 5A: Diagnosis
Multiple-Fault Diagnosis Using Faulty-Region Identification ................................................................. 123
Megn-Jai Tasi, Mango C.T. Chao, Jing-Yang Jou and Meng-Chen Wu

Predictive Test Technique for Diagnosis of RF CMOS Receivers ................................................................. 129
K. Suenaga, S. Bota, R. Picos, E. Isern, M. Roca and E Garcia-Moreno

Controlling DPPM through Volume Diagnosis ................................................................................................ 134
Xiaochun Yu, Yen-Tzu Lin, Wing-Chiu Tam, Osei Poku and R.D. Blanton

Session 5B: Delay Fault Testing and Signal Integrity
Scalable Compact Test Pattern Generation for Path Delay Faults Based on Functions ........................................ 140
Edward Flanigan, Spyros Tragoudas and Arkan Abdulrahman

The ATPG Conflict-Driven Scheme for High Transition Fault Coverage and Low Test Cost ........................................................ 146
Zhen Chen, Dong Xiang and Boxue Yin

A High-Level Signal Integrity Fault Model and Test Methodology for Long On-Chip Interconnections .............. 152
Sunghoon Chun, Yongjoon Kim, Taejin Kim and Sung Ho Kang

Session 6

Session 6A: Yield
False Path Aware Timing Yield Estimation under Variability ............................................................................. 161
Lin Xie, Azadeh Davoodi, Kewal K. Saluja and Abhishek Sinkar

Bridging DFM Analysis and Volume Diagnostics for Yield Learning - A Case Study ........................................ 167
Ritesh Turakhia, Mark Ward, Sandeep Kuma Goel and Brady Benware

Yield and Cost Analysis of a Reliable NoC ........................................................................................................ 173
Saeed Shamshiri and Kwang-Ting Cheng

Session 6B: BIST
Restrict Encoding for Mixed-Mode BIST .............................................................................................................. 179
Abdul-Wahid Hakmi, Stefan Holst, Hans-Joachim Wunderlich, Jürgen Schlöffel, Friedrich Hapke and Andreas Glowatz

A Scalable, Digital BIST Circuit for Measurement and Compensation of Static Phase Offset .......................... 185
Keith A. Jenkins and Lionel Li

Experimental Validation of a BIST Technique for CMOS Active Pixel Sensors .............................................. 189
Livier Lizarraga, Salvador Mir and Gilles Sicard

Session 7

Session 7A: Test and Verification
Physically-Aware N-Detect Test Relaxation ........................................................................................................ 197
Yen-Tzu Lin, Chukwuemeka U. Ezekwe and R. D. Blanton
Automatic Selection of Internal Observation Signals for Design Verification

Tao Lv, Hua-wei Li and Xiao-wei Li

STDF Memory Fail Datalog Standard

Ajay Khoche, Jay Katz, Sauro Landini, Kochen Liao, Neetu Agrawal, Glenn Plowman, Song-lin Zuo, Liyang Lai, John Rowe and Thomas Zanon

Session 7B: Transistor Aging and Power Supply Noise

Testing for Transistor Aging

Altug Hakan Baba and Subhasish Mitra

Layout-Aware Pattern Generation for Maximizing Supply Noise Effects on Critical Paths

Junxia Ma, Jeremy Lee and Mohammad Tehranipoor

Understanding Power Supply Droop during At-Speed Scan Testing

Pankaj Pant and Joshua Zelman

Special Session 7C: TTTC 2009 Best Doctoral Thesis Contest

Organizers: Yiorgos Makris and Haralampos Stratigopoulos
Moderator: Haralampos Stratigopoulos

Session 8

Special Session 8: New Topics: At-Speed Testing in the Face of Process Variations

Organizer: Bernard Courtois,
Presenter: Chandu Visweswariah

Session 9

Special Session 9: New Topics: Microscale and Nanoscale Thermal Characterization of Integrated Circuit Chips

Organizer: Bernard Courtois
Presenter: Ali Shakouri

Session 10

Session 10A: Test Compaction

Highly X-Tolerant Selective Compaction of Test Responses

Grzegorz Mrugalski, Nilanjan Mukherjee, Janusz Rajski, Dariusz Czysz and Jerzy Tyszer

Dynamic Test Compaction for Transition Faults in Broadside Scan Testing
Based on an Influence Cone Measure

Dong Xiang, Boxue Yin and Kwang-Ting Cheng

Maintaining Accuracy of Test Compaction through Adaptive Re-learning

SouNIL Biswas and R. D. Blanton

Session 10B: Test and Radiation Test

RT-Level Deviation-Based Grading of Functional Test Sequences

Hongxia Fang, Krishnendu Chakrabarty, Abhijit Jas, Srinivas Patil and Chandra Tirumurti
Analytical Model for Multi-site Efficiency with Parallel to Serial Test Times, Yield and Clustering ........................................................................................................... 270
Naveen Velamati and Robert Daasch

Diff Reuse for Low-Cost Radiation Testing of SoCs: A Case Study ........................................................................................................... 276

Session 11

Session 11A: Analog Test and Calibration

On-Line Calibration and Power Optimization of RF Systems Using a Built-In Detector ........................................................................ 285
Chaoming Zhang, Ranjit Gharpurey and Jacob A. Abraham

Calibration and Testing Time Reduction Techniques for a Digitally-Calibrated Pipelined ADC ........................................... 291
Hsiu-Ming Chang, Chin-Hsuan Chen, Kuan-Yu Lin and Kwang-Ting Cheng

A Time Domain Method to Measure Oscillator Phase Noise ........................................................................................................... 297
Kenneth Blakkan and Mani Soma

A Packet Based 2x-Site Test Solution for GSM Transceivers with Limited Tester Resources ........................................... 303
Erdem Serkan Erdogan and Sule Ozev

Session 11B: Emergent Technology and Security

Design-for-Testability for Digital Microfluidic Biochips ........................................................................................................... 309
Tao Xu and Krishnendu Chakrabarty

Stuck-Open Fault Leakage and Testing in Nanometer Technologies ........................................................................................................... 315
Julio Vazquez, Victor Champac, Chuck Hawkins and Jaume Segura

SS-KTC: A High-Testability Low-Overhead Scan Architecture with Multi-level Security Integration ........................................................................................................... 321
Unni Chandran and Dan Zhao

Characterization of Effective Laser Spots during Attacks in the Configuration of a Virtex-II FPGA ........................................................................................................... 327
Gaetan Canivet, Regis Leveugle, Jessy Clediere, Frederic Valette and Marc Renaudin

Special Session 11C: Embedded Tutorial: System-on-a-Chip Power Management Implications on Validation and Testing ........................................................................................................... 333
Organizer and Moderator: Bhanu Kappor

Session 12

Special Session 12A: Panel: Analog Characterization and Test: The Long Road to Realization ........................................................................................................... 337
Organizers: Arani Sinha and Amitava Majumdar
Moderator: Vasu Ganti

Special Session 12B: Panel: Functional Verification Planning and Management - Are Good Intentions Good Enough? ........................................................................................................... 338
Organizer and Moderator: Andrew Piziali

Author Index ........................................................................................................... 339