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Chapter 2. Device and Circuit-Level Modeling Measurement and Mitigation2.1 Overview; 2.2 Modeling Circuit-Level SERs; 2.3 Measurement; 2.4 Mitigation Techniques; 2.5 Summary; 2.6 Historical Anecdote; References; Chapter 3. Architectural Vulnerability Analysis; 3.1 Overview; 3.2 AVF Basics; 3.3 Does a Bit Matter?; 3.4 SDC and DUE Equations; 3.5 ACE Principles; 3.6 Microarchitectural Un-ACE Bits; 3.7 Architectural Un-ACE Bits; 3.8 AVF Equations for a Hardware Structure; 3.9 Computing AVF with Little's Law; 3.10 Computing AVF with a Performance Model
3.11 ACE Analysis Using the Point-of-Strike Fault Model3.12 ACE Analysis Using the Propagated Fault Model; 3.13 Summary; 3.14 Historical Anecdote; References; Chapter 4. Advanced Architectural Vulnerability Analysis; 4.1 Overview; 4.2 Lifetime Analysis of RAM Arrays; 4.3 Lifetime Analysis of CAM Arrays; 4.4 Effect of Cooldown in Lifetime Analysis; 4.5 AVF Results for Cache, Data Translation Buffer, and Store Buffer; 4.6 Computing AVFs Using SFI into an RTL Model; 4.7 Case Study of SFI; 4.8 Summary; 4.9 Historical Anecdote; References; Chapter 5. Error Coding Techniques; 5.1 Overview
5.2 Fault Detection and ECC for State Bits5.3 Error Detection Codes for Execution Units; 5.4 Implementation Overhead of Error Detection and Correction Codes; 5.5 Scrubbing Analysis; 5.6 Detecting False Errors; 5.7 Hardware Assertions; 5.8 Machine Check Architecture; 5.9 Summary; 5.10 Historical Anecdote; References; Chapter 6. Fault Detection via Redundant Execution; 6.1 Overview; 6.2 Sphere of Replication; 6.3 Fault Detection via Cycle-by-Cycle Lockstepping; 6.4 Lockstepping in the Hewlett-Packard NonStop Himalaya Architecture; 6.5 Lockstepping in the IBM Z-series Processors
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7.5 Backward Error Recovery with Fault Detection before Memory Commit

Sommario/riassunto

This book provides a comprehensive description of the architetural techniques to tackle the soft error problem. It covers the new methodologies for quantitative analysis of soft errors as well as novel, cost-effective architectural techniques to mitigate them. To provide readers with a better grasp of the broader problem deffinition and solution space, this book also delves into the physics of soft errors and reviews current circuit and software mitigation techniques. TABLE OF CONTENTSChapter 1: Introduction Chapter 2: Device- and Circuit-Level Modeling, Measurement, and Mitig