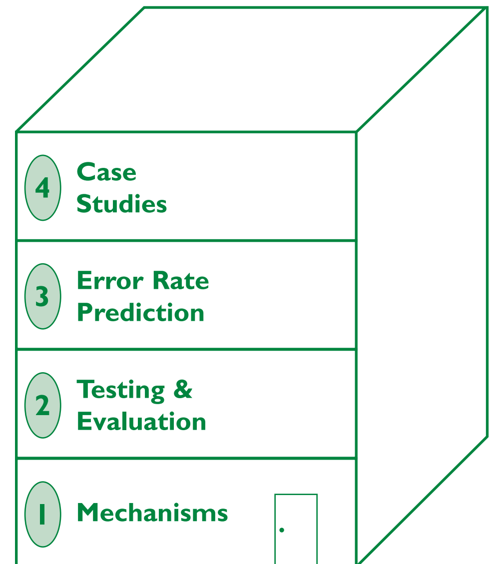
Announcement for the 2008 NSREC Short Course

Soft Errors: From the Ground Up

Monday, July 14, 2008
Tucson, Arizona

Sponsored by
IEEE/NPSS
Radiation
Effects
Committee

COURSE DESCRIPTION



A one-day Short Course "Soft Errors: From the Ground Up" will be presented at the 2008 Nuclear and Space Radiation Effects Conference (NSREC). This Short Course will provide a review of soft errors, also known as single event upsets, applying the "From the Ground Up" theme in many ways. The Short Course is organized into four sessions starting from a foundation of the mechanisms for the generation of soft errors. The second session will build on that foundation and cover the ground-based testing and evaluation of soft errors. How the results of soft error testing and evaluation are analyzed and applied to predict soft error rates follows in the third session of the Short Course. Finally, the last session will provide two different case studies of soft errors in microelectronic systems, one looking at a complex device in a space-based application and one looking at a simple device in a ground-based medical application.

The speakers for the 2008 Short Course are all experts in their respective area of soft errors. They will present the traditional knowledge base in their topical area and build upon that knowledge with current results that demonstrate where the knowledge base is being stretched. Examples of this include the decrease of the separation of charge collection volumes, the increase in the speed of microelectronic devices, and the application of novel circuit design techniques. The speakers will also discuss the challenges of applying ground-based testing and evaluation results to the prediction of space-based soft error rates.

The course is applicable to designers, radiation effects engineers, component specialists, and other technical and management personnel who are involved in developing reliable systems designed to operate in terrestrial and space environments. This course provides a unique opportunity for NSREC attendees to benefit from the expertise of the instructors as well as the in-depth coverage and application-oriented perspective provided by the short course format. Each instructor will develop the core content of their respective topics from background material largely found in the literature. As such, the course will benefit both new and experienced engineers, scientists, and managers. In-depth notes will be provided at registration.

For those interested in Continuing Education Units (CEUs), there will be an open-book test at the end of the course. The course is valued at 0.6 CEUs and is endorsed by the IEEE and the International Association for Continuing Education and Training (IACET).

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On behalf of the 2008 Nuclear and Space Radiation Effects Conference (NSREC) Committee, I cordially invite you to attend the 29th annual NSREC Short Course. This four-part course will focus on soft errors in microelectronics from ground to space-based implementations.

JEFF BLACK
2008 NSREC Short Course Organizer

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PART 1 – BASIC MECHANISMS FOR SOFT ERRORS

Prof. Robert Reed, Vanderbilt University, will present a discussion on the basic energy deposition, charge generation and collection mechanisms for single event soft errors. The course will begin with a brief discussion of the space radiation environments. Then he will describe physical interactions of radiation with matter that are important to understand single event soft errors. This will be followed by a discussion of basic charge generation, transport, and collection mechanisms. Finally, Prof. Reed will provide a discussion on issues related to advanced technologies.

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PART 2 – GROUND-BASED TESTING AND EVALUATION OF SOFT ERRORS

Craig Hafer, Aeroflex Colorado Springs, will discuss soft error (SE) testing of modern digital integrated circuits (ICs). SEs due to single ion events can be problematic for proper IC and system level operation. This section of the Short Course will introduce the purpose of terrestrial SE testing as a method to determine the effects and frequency of single event SEs on IC operation in a space environment. A comparison of galactic cosmic ray (GCR) flux and linear energy transfer (LET) to terrestrial testing flux and LET will be presented. Terrestrial ion accelerator SE test facilities will be listed along with a general discussion of test facility considerations. SE test planning, sample preparation, and test hardware and software preparation will be examined. An overview will be made of recent challenges due to complex, dense, high speed, small geometry technology IC devices.

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PART 3 – SOFT ERROR RESULTS ANALYSIS AND ERROR RATE PREDICTION

Dr. Edward Petersen, Consultant, will discuss the analysis and use of various types of single event data. A variety of experimental and analytical approaches have led to a variety of conclusions about single event mechanisms. Dr. Petersen will summarize these approaches and attempt to present a unified analysis. This will be followed by a discussion of the analysis and interpretation of heavy ion cross section curves. The section will then discuss the various approaches to heavy ion and proton rate predictions for the space environment, and present a variety of sample calculations. The final portion will be a summary of the success of the predictions in various space experiments.

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PART 4 – SOFT ERROR CASE STUDIES

Dr. Joseph Benedetto, Micro-RDC Colorado Springs, will present a case study in the evaluation of commercial memory circuits. Memories circuits are the subject of many soft error tests as they can sometimes dominate soft error rate predictions in a microelectronics system. Recent test results demonstrate the complexity involved in preparing for soft error testing as the observed failure modes are increasing. Additionally, memory devices are challenging to evaluate due to an increasing speed of operation and increasing number of operating modes.

Jeff Wilkinson, Medtronic, Inc., will discuss the challenges in designing for soft-errors in the ultralow power regime of implanted medical devices. Implanted electronic medical devices are required to operate reliably for many years using a non-renewable power source. Mr. Wilkinson will review the functions and operating requirements for implanted electronics emphasizing the particular case of a life-critical cardiac pacemaker. Error mitigation strategies that may be appropriate for this application will be presented and compared. Finally, some surprising results related to other radiation effects will be briefly discussed.

Visit the NSREC website at www.nsrec.com