

Radiation-induced Soft Errors: Status Quo and Key Challenges

Norbert Seifert
Logic Technology Development Q&R
Intel Corporation
5200 N. E. Elam Young Parkway
Hillsboro, OR 97124-5503
Norbert.Seifert@Intel.com

Radiation-induced soft errors have been a key reliability challenge to the commercial IC industry since the late 1970s. Whereas the susceptibility of DRAMs was the major issue then, it is now logic devices that limit the radiation robustness of modern components. The relentless dictate of Moore's Law compounded with the reduction of critical charges each technology generation pose a severe challenge to the semiconductor industry. Further, popular mitigation techniques that exploit the concept of local redundancy to mitigate the impact of soft errors are expected to show diminishing returns with technology scaling due to mechanisms such as charge sharing. These new mechanisms also aggravate accurate modeling strategies that are compatible with high volume, multiple product manufacturing environments.

Today's reliability engineers need to have a thorough understanding of the impact of device and component design on soft error rates. In this tutorial an overview of the physics, basic mechanisms, as well as modeling strategies of radiation-induced soft error rates from the device to chip-level are covered. Circuit-level mitigation techniques and challenges ahead conclude this short tutorial.

Norbert Seifert

Norbert Seifert currently is a Senior Staff Reliability Engineer with Intel Corporation in Hillsboro, Oregon, where he heads all technology radiation effects projects. Prior to joining Intel in 2003, he worked in the fields of compact modeling, device reliability and digital design in the Alpha Development Group (at DEC, CPQ and HP). Over his entire career, Dr. Seifert has worked extensively on the interaction of radiation with matter in general and on the response of digital circuits in particular. He is an internationally recognized expert in the radiation effects community and the author or co-author of more than 50 research papers, one book chapter and currently holds 4 patents. Dr. Seifert received Diplom Ingenieur and Ph.D. degrees in physics from Vienna University of Technology, Vienna, Austria, in 1990 and 1993, respectively. He also holds an M.S. degree in physics from Vanderbilt University (Nashville, TN, May 1994).