

The Influence and Modeling of Process Variation and Device Mismatch for Analog/RF Circuit Design

Yuhua Cheng
Siliconlinx, Inc.

Abstract

This talk will review the influence of local process variation and device mismatch to the electrical characteristics of resistors, capacitors, and MOSFETs. The discussion is mainly focus on the device mismatch as it becomes more and more important in analog design utilizing modern CMOS technology. The models to describe the mismatch behavior are also discussed. To reduce the design circle and help improving the circuit yields, physical and accurate statistical modeling approach is needed to predict correctly the circuit behavior with the consideration of local process variation and device mismatch. As an example, an advanced statistical model based on totally independent process variables is presented. It can predict the measured data well at different bias conditions for devices with wide geometries.

The Biography of Yuhua Cheng

Yuhua Cheng received the B.S. degree in electrical engineering, Shandong Polytechnic University (now Shandong University), Jinan, China in 1982, the M. S. degree in electrical engineering, Tianjin University, Tianjin, China in 1985, and the Ph.D. degree in electrical engineering, Tsinghua University, Beijing, China in 1989.

In 1990, he joined in the Institute of Microelectronics as a research fellow in the Department of Computer Science and Technology (DCST), Peking University, China. From 1992 to 1996, he was an associate professor in DCST. From 1994 to 1995, he was a Visiting Professor at the Norwegian University of Science and Technology, Trondheim, Norway, and a Research Fellow of the Norwegian National Research Council. From 1995 to 1997, he was a Senior Scientist at the Department of Electrical Engineering and Computer Sciences, University of California, Berkeley.

In 1997, he worked first for Cadence Design Systems as a Member of Consultant Staff and then joined Rockwell International. From 1997-2004, he worked for Rockwell Semiconductor Systems, Conexant Systems (a spin-off from Rockwell), and Skyworks Solutions (a spin-off from Conexant), where he was principal engineer, manager, and senior manager of mixed-signal/RF device (bipolar, MOS and passive) and technology team responsible for Mixed-signal/RF device technology development, modeling and technology support for various (ASIC, analog, Mixed-signal, RF) circuit designs. He is currently with Siliconlinx, Inc., which offers products and services to bridge the gap between IC designers and manufacturing foundries.

He has served many technical program committees and chairs in international conferences, including the IEEE Custom Integrated Circuits Conference (CICC) since 2001 and Radio Frequency Integrated Circuits Symposium since 2002. He organized and participated in several workshops and panels related to RFCMOS technology and SOC design. He has authored and co-authored over 80 research papers, several book chapters, two books "MOSFET Modeling & BSIM3 User's Guide" by Kluwer Academic Publishers, and "Device modeling for analog/RF circuit design" by John Wiley and Sons.

He is a senior member of IEEE and an EDS Distinguished Lecturer. He serves the Administration Committee of IEEE Electron Device Society (EDS). He is a member of the Membership Committee and a member of the Regions/Chapter Committee of IEEE EDS and the vice-chair of the North America West subcommittee for Regions/Chapters (SRC-NAW) of the EDS Regions/Chapters Committee.