

EECS Seminar Series



Dr. Adelmo Ortiz-Conde

Professor, Department of Electronics, Universidad Simón Bolívar, Venezuela

“A review of recent Integration-based Methods for Parameter Extraction and Distortion Evaluation”

Thursday, March 5, 2009 • 12:00 p.m. • Harris Center (HEC) 101

We present a historic overview of the initial motivating ideas, original foundations, and subsequent development, of integration-based methods which are currently used to extract semiconductor device model parameters, as well as to assess devices' and circuits' non-linearities. To illustrate these methods' capabilities, we review sample applications such as non-ideal junctions, illuminated solar cells, post-breakdown conduction through thin oxides, MOSFET models and harmonic distortion evaluation. As far as we know, the first integration-based parameter extraction method was proposed by Araujo in 1982 and it was specifically for the determination of parasitic series resistance in solar cells. Integration acts as a low pass filter and, thus, tends to lessen the effect of measurement errors on the extraction procedure. This extraction method was generalized in 1995 for an arbitrary two-terminal device with a series resistance. An opposite approach, a method that eliminates the effects of the parasitic series resistance, was presented in 1996 by using a new integral function denominated D. Function D was generalized to a family of functions which is able to eliminate any given coefficient of a polynomial. Function D was used in 2002 to design, optimize and fabricate a bipolar transistor with maximum static transfer function linearity. This transistor was composed of two parallel-connected non-linear blocks: a hyperbolic tangent-type transistor and hyperbolic sine-type transistor. This transistor work inspired the same year, the development of a procedure to evaluate harmonic distortion using function D.

A new method for the extraction of coefficients in an nth-order polynomial function was presented in 2007 based on using successive integrations. This method was still not fully immune to experimental noise because it involved operations which did not include integration of the device's static I-V characteristics. This limitation was removed in 2008 by the new method denominated “Full Successive Integrals Method” (FSIM). This method can be used as an efficient tool to calculate any kth-order harmonic distortion in semiconductor devices for any input amplitude, without having to perform Fourier or AC analysis. We will also review and scrutinize the following existing integration-based methods for extracting threshold voltage in MOSFETs, biased in the linear region: (1) integral method; (2) transition method; and (3) Normalized mutual integral difference operator method. We will also review the following two integration-based methods for extracting threshold voltage in the saturation region: (1) H function method and (2) G1 function method. Finally, we will review a method to evaluate the location of a maximum value of a given function with high level of noise by using integration.

DR. ADELMO ORTIZ-CONDE

Adelmo Ortiz-Conde (S'82, M'85, SM'97) was born in Caracas, Venezuela, on November 28, 1956. He received the B.S. degree in Electronics from the Universidad Simón Bolívar, Caracas, in 1979 and the M.E. and Ph.D. from the University of Florida, Gainesville, in 1982 and 1985, respectively. From 1979 to 1980, he served as an instructor in the Department of Electronics at the Universidad Simón Bolívar. In 1985, he joined the technical Staff of Bell Laboratories, Reading, PA, where he was engaged in the development of high voltage integrated circuits.

Since 1987 he has been with the Department of Electronics at the Universidad Simón Bolívar and he was promoted to Full Professor in 1995. He was on sabbatical leave at the Florida International University, Miami, from September to December 1993, and at the University of Central Florida (UCF), Orlando, from January to August 1994, and again from July to December 1998, and at CINVESTAV, Mexico City, Mexico, from October 2000 to February 2001. He has authored one textbook, 76 refereed journal articles (including 4 invited review articles) and 67 papers (including 11 invited papers) in international conference proceedings. His present research interest includes the modeling and parameter extraction of semiconductor devices. Dr. Ortiz-Conde is Member of Eta Kappa Nu, Tau Beta Pi, Phi Kappa Phi and the Galilean Society. He is an EDS Distinguished Lecturer and he is the Chair of IEEE's CAS/ED/PE Venezuelan Chapter. He is a Member of the Editorial Advisory Board of Microelectronics and Reliability.