



Automated extraction of nonlinear oscillator macromodels and their use for fast simulation of VCOs, PLLs and bio/nano systems

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Abstract

We will present results from our recent research on methods for speeding up VCO/PLL simulation while retaining accuracy. PLL problems are one of the most important factors responsible for malfunction of mixed-signal systems. Hence detailed and accurate simulation is important during design; however, SPICE-level simulation of PLLs for jitter, capture behaviour and other effects is too time-consuming to be practical. We will review algorithms for push-button extraction of simple nonlinear phase macromodels of the VCOs within PLLs. We will describe the application of this macromodel to quickly and accurately predict various important PLL phenomena, including power grid noise induced jitter, capture and lock transients, static offset and cycle slipping, injection locking, etc. In prototype implementations, we have obtained speedups of 2 to 3 orders of magnitude over SPICE-level simulations. We will also present initial results on fast envelope methods for further speeding up oscillator/PLL simulation. If time permits, we will also illustrate applications of automated oscillator macromodelling to biological and nanoelectronic systems.

Biography:

Jaijeet Roychowdhury received the Bachelor's degree in electrical engineering from the Indian Institute of Technology, Kanpur, India, in 1987, and the Ph.D. degree in electrical engineering and computer science from the University of California at Berkeley, in 1993. From 1993 to 1995, he was with the Computer-Aided Design (CAD) Laboratory, AT&T Bell Laboratories, Allentown, PA. From 1995 to 2000, he was with the Communication Sciences Research Division, Bell Laboratories, Murray Hill, NJ. From 2000 to 2001, he was with CeLight Inc. (an optical networking startup), Silver Spring, MD. Since 2001, he has been with the Electrical and Computer Engineering Department and the Digital Technology Center, University of Minnesota, Minneapolis.

Roychowdhury's professional interests include the design, analysis, and simulation of electronic, electrooptical, and mixed-domain systems, particularly for high-speed and high-frequency communication circuits. He was cited for Extraordinary Achievement by Bell Laboratories in 1996. Over the years, he has co-authored five best or distinguished papers at ASP-DAC, DAC,

and ICCAD. He was an IEEE Circuits and Systems (IEEE CAS) Society Distinguished Lecturer during 2003-2005 and served as Program Chair of IEEE's CANDE and BMAS workshops in 2005. Currently, he serves on the Technical Program Committees of DAC, DATE, ASP-DAC and ISQED, on the Executive Committee of ICCAD, and on the Nominations and Appointments Committee of CEDA. He holds 10 patents.

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