IEEE Coastal Los Angeles Section, Joint Chapters of the
COMMUNICATIONS, SIGNAL PROCESSING AND VEHICULAR TECHNOLOGY SOCIETIES

IEEE Presents:

State-of-the-Art Time-Domain Measurement and Modeling Techniques for Nonlinear Components and Systems

Dr. Christopher P. Silva, The Aerospace Corporation

Wednesday, 7 December 2011
11:30 a.m. – 11:45 a.m. Pizza & Networking
11:45 a.m. – 1:00 p.m. Seminar
No charge, non-members welcome

The Aerospace Corporation, Building: D8, Room: 1010
200 N. Aviation Ave, El Segundo, CA 90245
Chair: Ramon Grijalva, Addison Burnet Group, Inc.

Please RSVP by 30 November 2011 to Ms. Janice Penland, via e-mail Janice.D.Penland@aero.org
Please identify your citizenship, IEEE membership (non-members welcome), and affiliation when you RSVP

Abstract

The increasing demands for performance, mobility, and services in difficult physical channel and frequency allocation environments, in both commercial wireless and military contexts, pose formidable new challenges to communications designers. Arguably the most important of these major challenges is the classical trade between power efficiency and performance-limiting nonlinear distortion of the amplifiers used in such systems. This balance is exacerbated by the use of non-constant envelope modulations needed to achieve high bandwidth efficiencies, as well as multi-carrier protocols to simultaneously support many users. Current activity in these areas has especially focused on the system-level or behavioral modeling of solid-state power amplifiers, with concomitant efforts on efficiency enhancement and distortion compensation, the latter in the form of predistorters, linearizers, and equalizers. Refined nonlinear measurement and modeling approaches will be required to successfully support these efforts, which will only escalate in difficulty with the use of increasingly complex and broader bandwidth signaling schemes.

This presentation introduces and describes highly accurate baseband time-domain measurement and modeling techniques applicable to nonlinear communication components and systems having bandwidths ranging up to several GHz. It will begin with an overview and comparison of time-domain versus frequency-domain measurements as they pertain to nonlinear components and systems. The development and details of a baseband time-domain measurement technique and system will follow, which provides state-of-the art measurement accuracies of time-domain waveforms crucial to design verification, model construction/validation employing operational modulated signals, and system-level troubleshooting. The important, but often neglected issue of what model fidelity is required to support the accurate estimation of system performance metrics, such as the ubiquitous bit error rate (BER), will be addressed. A survey of some common frequency-domain blackbox modeling approaches will be described and evaluated, indicating their inadequacies for wideband and complex modulations. Finally, an introduction will be given of a new systematic approach, termed the polyspectral method, which is based on time-domain input/output measurements involving operational modulated signals. This method provides a powerful set of tools, and numerous benefits for the state-of-the-art nonlinear modeling and distortion compensation of communications systems. This claim will be illustrated by a resoundingly successful polyspectral model variant for both solid-state and traveling-wave tube amplifiers, as well as a brief survey of the method's application to distortion compensation design/evaluation.

Bio

Dr. Christopher P. Silva received the B.S., M.S., and Ph.D. degrees, all in electrical engineering, in 1982, 1985, and 1993, respectively, from the University of California at Berkeley. Professor Leon O. Chua directed his graduate work with an emphasis on nonlinear circuit and system theory. He joined the Electronics Research Laboratory of The Aerospace Corporation in 1989 and is currently a Senior Engineering Specialist in the Communication Electronics Department, Communications & Networking Division. He has been the principal or co-investigator on several internally funded research projects addressing nonlinear microwave CAD, private/secure communications and radar by means of chaos, stability analysis of nonlinear circuits, and the measurement, modeling, and compensation of nonlinear satellite communications channels, the latter of which has become an advanced technology development for several military space programs. He has delivered many invited talks, seminars and lectures at conferences, society meetings, universities, industry, and laboratories on the applications of nonlinear techniques to communications and signal processing, along with corresponding publications in various venues. He has also been a co-organizer of several conference workshops, and has begun to co-develop and help teach a full-day international symposium short course on nonlinear stability concepts, computer-aided analysis, and design for microwave circuits and systems. Dr. Silva is a Fellow of IEEE, a Senior Member of AIAA, and a member of AMS and SIAM.

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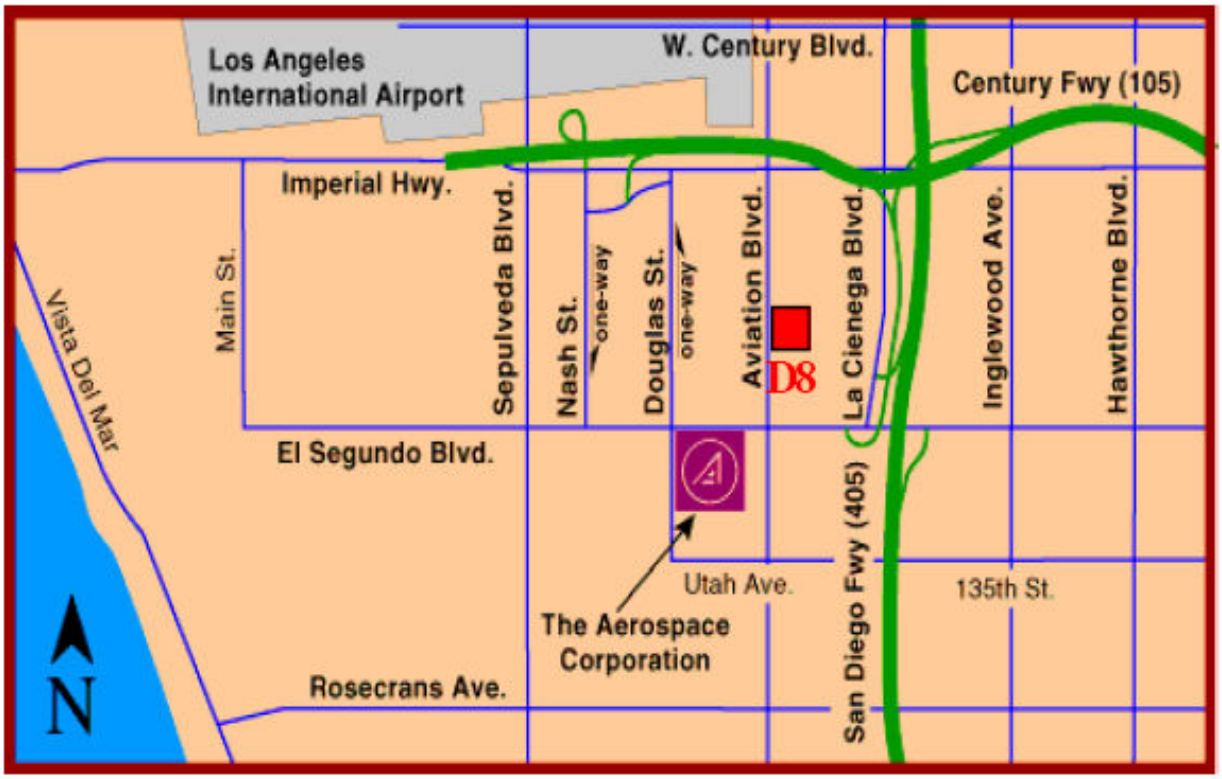

Directions

From the southbound San Diego Freeway (Interstate 405):

1. Exit at El Segundo Blvd (La Cienega Blvd).
   (Just past the I-105 interchange).
2. Turn left at bottom of ramp onto La Cienega.
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5. Enter gate for The Aerospace Corporation on right side of street.

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