Nonlinear Measurement Workshop

72th ARFTG, FALL 2008, Wednesday Dec. 10 1:20 PM – 5:00 PM, Portland, OR

The Nonlinear Measurement Workshop theme is "**Time domain approaches: issues, solutions, and evaluations**." Learn about the state-of-the-art of time-domain waveform measurement of active devices at microwaves. Experts of the field will present load-pull solutions, the possible applications of the information and give insights into accuracy issues and uncertainty causes. .

Scheduled Speakers:

1:20pm – 2:00pm	Kate Remley – NIST,
2:00pm – 2:40pm	Johannes Benedikt – Cardiff University,
2:40pm – 3:20pm	Basim Noori – Freescale Semiconductor,
3:20pm – 3:40pm	Coffee break,
3:40pm – 4:20pm	Jan Verspecht – JanVerspect b.v.b.a.,
4:20pm – 5:00pm	Sandro Pinarello – Infineon.

Organizer: Valeria Teppati – Politecnico di Torino, Italy

Sampling Oscilloscope Metrology for Modulated Signals

Kate Remley

Abstract: Sampling oscilloscopes provide a solution for traceable measurement of wideband modulated signals. We describe metrology issues related to measurements of modulated signals using sampling oscilloscopes, including calibration, jitter and timebase distortion correction, and practical aspects of data conditioning. These issues are illustrated with examples.

Kate A. Remley (S'92-M'99-SM'06) received the Ph.D. degree in Electrical and Computer Engineering from Oregon State University, Corvallis, in 1999. She is the Leader of the Metrology for Wireless Systems Project in the Electromagnetics Division of NIST. Her research activities include development of new, more accurate and efficient measurement methods for wireless systems, characterizing the link between nonlinear circuits and system performance, and developing methods for improved radio communications for the public safety community. Current projects include developing calibrations for measurements of fundamental parameters such as power and electric field under wideband, modulated-signal excitation. Dr. Remley has been at NIST since 1999, and was the recipient of the Department of

Commerce Bronze and Silver Medals, the Automatic RF Techniques Group (ARFTG) Best Paper Award, and an ARFTG Service Award.

Waveform Engineering and its Applications

Johannes Benedikt

Abstract: The waveform engineering approach for active devices measurement is explained, and the key advantages are shown. The setup is described with many details, in order to achieve versatile envelope load-pull measurements. Then many results are proposed in order to demonstrate the efficiency of waveform engineering, especially for the design of an inverse class-F power amplifier.

Johannes Benedikt received the Dipl.-Ing. degree in electrical engineering from the University of Ulm, Germany in 1997, and his Ph.D. degree from Cardiff University, UK in 2002. During this time he took on an additional position as a Senior Research Associate at Cardiff University starting at October 2000 supervising a Research Program with Nokia. In December 2003 he was appointed a Lecturer at Cardiff University. His research activities include the management of the High Frequency Laboratory at the School of Engineering with responsibilities for industry sponsored research projects in the fields of large-signal measurement systems, large-signal device characterization, including novel active harmonic load pull systems, and the development of efficient and linear high power RF amplifiers.

Comparison of Passive and Active Load-Pull Systems in High Power Amplifier Measurement Applications

Basim Noori

Abstract: This presentation proposes a very accurate and in depth comparison of passive and active load-pull systems, and many details about the measurement results that can be obtained. The destructive conditions of DUT (negative impedances, instabilities) on such setups are deeply discussed. Then, it focuses on the specific interest of time domain measurements applied to active and passive load-pull systems.

Basim Noori received an Electrical Engineering Diploma from the Higher Technical Institute, Nicosia, Cyprus, in 1991, and the MSc degree in Mobile Communication Systems from the University of Surrey, Guildford, U.K. is 2000.
He served as a power amplifier designer at Nokia Telecommunication (UK), Tropian Inc. and REMEC/Spectrian before joining the RF division of Freescale Semiconductor Inc. in Tempe Arizona as the Load Pull and microwave measurement engineering manager. He is currently pursuing a PhD at Cardiff University in the United Kingdom.

Advanced time domain loadpull characterization of microwave power transistors

Jan Verspecht

Abstract: The time domain multi-harmonic load-pull approach is explained. The so-called “wave-probe” coupling approach allows passive harmonic load-pulling with wave information taken very close to the DUT. Many time domain waveform results are discussed, showing the interest of high power transistor measurements.

Jan Verspecht, IEEE Fellow since 2007, was graduated from the "Vrije Universiteit Brussel" (VUB) in 1990. He started working as a research engineer for the "Network Measurement and Description Group". He received the doctoral degree in November 1995. As a Ph.D. student Jan developed the "nose-to-nose" calibration procedure for broadband sampling oscilloscopes and its use as a harmonic phase standard for voltage/current waveform measurements. He also contributed to the RF hardware and system level software of the first LSNA prototype. Then he investigated how the LSNA system could be used for extracting measurement based black-box frequency domain models for systems and components. He invented a multi-frequency "Describing Function" concept, now famous as the so-called “X-Parameters”. In 2003 Jan founded the company "Jan Verspecht b.v.b.a." and started working as an independent consultant; and in 2008 he founded the “Verspecht-Teyssier-DeGroote s.a.s.” company, providing a new RF receiver for time domain measurements.

Stability of Harmonic Phase Reference in a Specific Example of Load Pull System

Sandro Pinarello

Abstract: In the active load-pull system presented, a VNA is used as a receiver, and a Harmonic Phase Reference is used to rebuild the time domain waveforms. The setup calibration requires three steps: S-parameters calibration, power calibration and phase calibration.
Measurement activity shows how delicate is the last step of the calibration in order to correctly reconstruct input and output signal in time domain. An investigation is therefore run to determine the influence of time, temperature and power level to the reference input port of the VNA on the validity of the last performed calibration. As a result of the observation of the non linear behaviour of the VNA receiver a new HPR generator configuration is investigated in a dedicated experiment.

Sandro Pinarello received the degree in telecommunications engineering from the University of Padova in 2005 with a dissertation on the synthesis of a phased array antenna with fractal elements for broadcast signal reception. In 2005 he joined the University of Liverpool as a researcher on a project on signal processing techniques aiming at image enhancement and classification for marine radar. Here he led the development of a method to enhance the presence of targets in sea clutter via multiple radar scans. In 2006 he was invited by McMaster University of Hamilton, Toronto, as a research student. He joined Fracarro Radioindustrie Spa in 2007 where he worked in the R&D department as an RF electronics and antenna designer. In 2008 he was appointed as a Ph.D. student by Infineon Technologies. His research topic is measurement techniques for power amplifier characterisation. As part of this topic his interests are focusing on active load pull systems, experimental data analysis, modelling, and degradation analysis.