"Nonlinear Measurements for RF Power Amplifier Characterization and Modeling using a Keysight PNA-X"

Keysight Technologies Seminar at University of Bologna

21st December 2016, h. 12:00 – Aula Magna – Viale Risorgimento, 2
Dipartimento di Ingegneria Elettrica e dell'Informazione "Guglielmo Marconi"

Abstract

This workshop is focused on the characterization and modeling of radio-frequency power amplifiers by means of nonlinear microwave measurement techniques. Aspects of research and methods carried out by the EDM-LAB group are introduced, while Keysight Technologies (ex Agilent) will present trends and challenges of 5G applications, including its own ongoing industrial research. In particular, the PNA-X general purpose measurement platform by Keysight is shown in a demo. This set-up is used to demonstrate some of the most recently developed PNA-X nonlinear measurement capabilities, including RF PA long-term memory effects characterization, model extraction, and interaction with simulations.

Agenda

12:00 – 12:15	"Overview of research activities of EDM-LAB @ DEI" by Prof. Alberto Santarelli, University of Bologna
12:15 – 12:45	"Keysight PNA-X: a Lab-in-a-box for Nonlinear Component Characterization" by Francesco Tafuri, Aalborg University and Keysight Technologies
12:45 – 13:00	Coffee break
13:00 – 13:45	"Nonlinear Measurements for RF Power Amplifier Characterization and Modeling using a Keysight PNA-X" by Francesco Tafuri, Aalborg University and Keysight Technologies
13:45 – 14:15	Keysight PNA-X Demo
14:15 – 14:30	Overview of master thesis and internship opportunities @Keysight

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Troels Studsgaard Nielsen, Felice Francesco Tafuri

Abstract - The evolution towards the 5th Generation (5G) of mobile communications is once more posing though requirements on the components of Radio Frequency (RF) transceivers, especially the RF Power Amplifiers (PAs). The design of RF PAs has become an even more challenging task, requiring more and more advanced characterization and modeling tools. Keysight PNA-X provides the solution to such measurement challenges in the form of a very versatile measurement platform including multiple internal RF sources, wideband receivers, RF pulse modulators, internal bias-tees and wideband couplers. Keysight NVNA (Nonlinear Vector Network Analyzer) application software allows to use the PNA-X for a wide range of nonlinear measurements such as gain compression, intermodulation products, harmonic measurements, RF pulsed measurements, load-pull characterization, X-parameter extraction. In this seminar the Keysight PNA-X measurement capabilities will be described by means of measured results obtained in different research projects carried out at Keysight Technologies Labs in Aalborg, Denmark including Dynamic X-parameter modeling, multi-sine decomposition algorithm design and active load-pull characterization.

Speakers

- **Troels Studsgaard Nielsen** received the Master and Ph.D. degrees in electrical and electronic engineering from Aalborg University, Denmark in 2002 and 2006, respectively. He is currently a Research Scientist with the Measurement Research Labs. in Keysight Technologies, Rotselaar, Belgium. From 2005 to 2009, he worked as Senior RF Design Engineer in the Corporate R&D Modeling Group in RFMD, Greensboro, North Carolina, USA. His current work focuses on research and development of large-signal nonlinear models for III-V technology power amplifiers and large-signal measurements for nonlinear model development and validation. His technical interests include techniques for system level modeling, nonlinear system identification techniques, large-signal nonlinear measurements, and power amplifier linearization techniques. He has authored a dozen technical papers, articles, and book contributions within the fields of RF/microwave IC design, characterization, and modeling.

- **Felice Francesco Tafuri** received the B.Sc. in 2007 and the M.Sc. in 2010 in Electronics Engineering, both cum laude, from the Polytechnic of Bari, Italy. In 2014 he obtained the Ph.D. degree in the Wireless Communication program at Aalborg University, Denmark with a dissertation on linearity and efficiency enhancement of mobile communication power amplifiers. In 2013 he was the recipient of the European Microwave Conference Young Engineer Prize. Since 2014 he is with Keysight Technologies Denmark, where he is involved in an industrial postdoctoral project on advanced high efficiency transmitter characterization and modeling in partnership with Aalborg University and the Danish High Technology Foundation (HTF). His research interests include nonlinear measurement techniques, behavioral modeling and linearization of RF power amplifiers, digital predistortion architectures and their hardware implementation, efficiency enhancement techniques for RF power amplifiers and advanced envelope tracking transmitter architectures.