WWC (IMS/ARFTG) Wednesday 13:00 – 17:00 BCEC Room 152
Advanced Measurement Techniques, Adapted for Different Memory Effects
Half-day workshop reviewed by MTT-11, MTT-1, IMS09, ARFTG09, IMS-S TC33

Organizer(s):
Dominique Schreurs, K.U.Leuven, Belgium; AdCom, TCC, MTT-11, IMS TPC.
Marc Vanden Bossche, NMDG, Belgium.

Memory effects in transistors and amplifiers are troublemakers from the early days. The goal of this workshop is to give an overview of the present state-of-the-art characterization techniques in relation to the different types of memory effects that can occur within transistors and amplifiers. This workshop will provide you with an understanding of the different measurement setups that provide the necessary information to develop, for example, linearization techniques. The first talk focuses on the different memory effects for emerging wideband PA designs and clarifies the importance of an in-depth understanding. Related to these different types of memory effects, the other talks elaborate on the different state-of-the-art measurement techniques to properly characterize and quantify these effects, going from DC via small-signal measurements to large-signal measurements.

Speakers:
1. Nuno Borges Carvalho, IT, Portugal
"Importance of Memory Effects from a Designer Point of View"

Nonlinearity of wireless power amplifiers is a drawback for RF/microwave system engineers, since it degrades the overall communication path. In order to minimize this problem, RF engineers often use linearization schemes. If the characteristics of the power amplifier exhibit a low-frequency change in its response, then the degradation of the linearization scheme may become a serious problem. In this talk we will discuss memory effects from a design perspective. For instance we will try to answer questions as: what are the origins of memory effects? How are they manifested? How are they quantified? and how can designers incorporate memory effects into behavioral models and linearization schemes?

2. Leo de Vreede, T.U.Delft, Netherlands
"Large-Signal Device Characterization for Wide-Band PA Applications"

In this presentation an overview will be given on measurement techniques that address the needs in device and circuit characterization for modern wide-band communication systems that use complex modulated signals like (W)CDMA. To support the extraction of device models that include thermal memory effects, Isothermal device characterization setups (DC & RF) will be presented. For the verification of the Large-Signal operation itself, advanced active harmonic load-pull setups will be presented that can handle wide-band communication signals in a realistic way. These new systems prove to be excellent tools in device characterization, large-signal model verification, as well the characterization of base-band and thermal memory effects. It will be shown that using

this equipment new matching strategies can be developed for improving the linearity - efficiency trade-off of active devices.

3.Christian Fager, Chalmers University, Sweden
“Electrical Characterization of Self-Heating Effects”

In this talk a general method for characterizing electrothermal interaction due to self heating will be presented. The characterization is performed using only electrical measurements and is directly applicable to a wide range of device technologies. • A rigorous small-signal analysis of the electrothermal problem forms the basis for the characterization and model parameter extraction technique. * The proposed technique allows for extraction of both the thermal impedance and the thermal coefficient. * The small-signal analysis is valid for any N-port subject to self-heating from a single heat source. * The main advantage with the proposed method is that the extraction is made at a single independent bias condition. * This allows for the extraction of a bias dependent electro thermal model; a significant improvement compared to other electro thermal extraction techniques.

4. Anthony Parker, Macquarie University, Australia
“Measurement and Modeling of FET/HEMT Trapping Dynamics”

Pulse characteristics exhibit a seemingly chaotic relation to timing and bias, which is evidence of memory. Charge trapping within field-effect transistors is acknowledged as a significant source of memory. However, the challenge for interpretation of pulse and large-signal RF measurements is the large number of permutations of trap polarity, trap location, sources of trapped charge, and number of trap sites. This session will attempt to demystify the understanding of trapping processes and demonstrate that a simple generic model of a trap center, suitable for implementation in circuit simulators, can become the focus for interpreting transistor memory. Along with a good thermal-electric model, it is possible to classify various pulse characteristics, so that the nature of traps can be inferred. The interplay with both heating and channel breakdown and the relationship to linearity are interesting aspects that will be considered.

5.Christophe Gaquiere, IEMN, France
“Time Domain Analysis of Trapping Effects of AlInN/GaN HEMT Devices”

A specific characterization procedure of fast trap will be presented. This one will correlated witht the output pouwer preformances obtained on wide band gap AlInN/GaN HEMT devices.