



2009-11-27

Licentiate seminarium – Per Landin
“On Radio Frequency Behavioral Modeling”

Opponent: Prof. Wendy Van Moer, Vrije Universiteit Brussels

Plats: Hörsal 99131, Kungsbäcksvägen 47, Gävle

Tid: Torsdag 10 December 2009, kl. 10:00

The seminar will be held in English.

Abstract:

Radio frequency (RF) power amplifiers (PA) are still the most troublesome part of a wireless system due to their inherent nonlinearity, low power efficiency and high distortions. Better tools are needed to understand and correct the undesirable behavior. Some of these tools are behavioral models. A behavioral model is often thought of as a black box with some inputs and some outputs. In the case here these inputs are sampled signals which means that the modeling amounts to finding a mathematical relationship between the input signal(s) and the output signal(s).

This thesis considers some requirements for behavioral modeling of said systems by presenting methods for general performance evaluation and improvement by considering a frequency weighted error criterion. A high performance measurement system is also needed. The performance of the available system is compared to the performance of a well recognized system, the large signal network analyzer (LSNA). The results show that the existing measurement system can extract behavioral models with the same performance as the LSNA and can give lower performance validation errors.

Still the need for higher bandwidths drives the measurement systems to the limits, especially the digital parts. By utilizing the so called Zhu-Frank generalized sampling theorem, behavioral modeling of a PA is done by using data acquired at a sampling rate lower than the Nyquist rate. Models of a PA are extracted and the performance is evaluated using the normalized mean square error (NMSE) criterion.

For prediction and correction of the output signals the stability of the models regarding changes must be investigated. One such study considering controlled variations on the output load of the PA is done and both the predictive and corrective capabilities of the models are evaluated. The predictive capability gets up to 7 dB worse measured as adjacent channel error power ratio (ACEPR) and the corrective, as digital predistortion, gets up to 13 dB worse measured as adjacent channel power ratio (ACPR).