CARLETON UNIVERSITY WIRELESS SEMINARS

IEEE Distinguished Lecture

Hosted jointly by the Communications Society and Vehicular Technology Society

Wednesday, January 10, 2024, 2:00-3:00 pm | in-person
Mackenzie Building (ME), Room: 4359, Carleton University
https://carleton.ca/campus/wp-content/uploads/map.pdf

Achieving High Power Efficiency with Variable Envelope Signals

Professor Rui Dinis, Nova University of Lisbon (UNL), Portugal

Future wireless communication systems will require substantial spectral efficiency increase, which must be achieved while maintaining or even improving the power efficiency. Current amplifiers have very low amplification efficiency, especially when used with variable envelope broadband signals like the OFDM-based schemes and single-carrier schemes with compact spectrum, both employed in most wireless land and satellite communications. In fact, the maximum amplification efficiency for quasi-linear amplifiers (like class-A amplifiers) is 50%. This value drops to 5-10% when high-PAPR signals are employed. By using strongly nonlinear, switched amplifiers (like class D or F amplifiers), we can increase the maximum theoretical amplification to 100%, but the strong nonlinear distortion levels preclude its use with variable-envelope signals.

In this presentation, we make an overview on current block transmission techniques and power amplification schemes, with their advantages and limitations. We also present an innovative and highly disruptive amplification scheme named quantized digital amplification (QDA), which can overcome those limitations. It is shown that the QDA allows a quasi-linear amplification of variable-envelope signals like OFDM ones, while maintaining very high energy efficiency, being able to fulfill the spectral masks and EVM (Error Vector Magnitude) requirements of the most demanding wireless systems, including OFDM-based MIMO systems employing large QAM constellations. The power efficiency gains of the QDA allow significant improvements in bit rates and coverage for wireless systems in general.

Rui Dinis received the Ph.D. degree from IST, Technical University of Lisbon, Portugal, in 2001 and the Habilitation in Telecommunications from FCT, Nova University of Lisbon (UNL) in 2010 where he is a Full Professor. Rui Dinis is also researcher at IT (Instituto de Telecomunicações). During 2003 he was a visiting professor at Carleton University.

Rui Dinis is an IEEE ComSoc Distinguished Lecturer and an IEEE VTS Distinguished Speaker. He is or was editor at several major IEEE journals (IEEE TWC, TCOM, TVT and OJ-COMS) and at Elsevier Physical Communication and Hindawi ISRN Communications and Networking. He was also a guest editor for multiple special numbers in several journals. He was involved in the organization of IEEE conferences, namely several VTC and GLOBECOM, and is a member of several technical committees of IEEE Communications Society.

Rui Dinis has been actively involved in several international research projects in the broadband wireless communications area. He has 30 PhD students (current and past), published 7 books, over 200 journal papers and book chapters and over 400 conference papers (of which 5 received best papers' awards), and has over 20 patents. He was involved in pioneer projects on the use of mm-waves for broadband wireless communications and his main research activities are on modulation and transmitter design, nonlinear effects on digital communications and receiver design (detection, equalization, channel estimation and carrier synchronization), with emphasis on frequency-domain implementations, namely for MIMO systems and/or OFDM and SC-FDE modulations. He is also working on cross-layer design and optimization involving PHY, MAC and LLC issues, as well as indoor positioning techniques.