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ELECTRICAL & COMPUTER ENGINEERING
TEXAS A&M UNIVERSITY

S E M I N A R

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Circuits and Architectures for Pulse-Width Modulation Based Transmitters

by

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Abstract: Pulse-width modulation (PWM) encodes the amplitude information of a signal in the duty cycle of a periodic pulse waveform that is switching at a frequency much higher than the bandwidth of the signal itself. Combined with a switched-mode driver amplifier, such as a class-D stage, PWM offers an efficient approach for implementing transmitters. The approach is especially well-suited for digitally-intensive, CMOS-friendly implementations. While PWM combined with a class-D output stage has been very effectively employed in audio systems, its use in wider bandwidth applications such as wireless and wireline systems requires an exploration of new circuit techniques and architectures.

In this talk, we will describe PWM-based transmitter architectures for applications where the signal bandwidth can extend from several hundreds of KHz to tens of MHz. Baseband PWM implementations and RF-PWM architectures, that allow for PWM generation at RF, without the requirement for frequency upconversion, will be described. An overview of the benefits and potential limitations of the PWM approach will be presented.

Practical implementations including a transmitter for Powerline (PLC) applications, an RF-PWM transmitter for LTE machine-type communication applications and a transmitter for WiFi signals will be presented. Specialized circuit and architectural techniques employed in each design will be outlined.

Ranjit Gharpurey is a Professor in the Department of Electrical and Computer Engineering at the University of Texas at Austin. He received his Ph. D. from the University of California at Berkeley in 1995, and his B. Tech. from the Indian Institute of Technology, Kharagpur in 1990. He was an Assistant Professor at the University of Michigan, Ann Arbor from 2003 to 2005, prior to which he was with Texas Instruments Incorporated, Dallas, TX, from 1995 to 2003.

His research interests are in analog circuit design, with emphasis on RF and wireless communication applications, low-power design techniques, and techniques for improving efficiency and dynamic range in analog circuits. Prof. Gharpurey was a corecipient of Best Student Paper Awards at the IEEE Dallas Circuits and Systems Conference in 2014, the IEEE RFIC Symposium in 2008 (first place) and IEEE Sensors Conference in 2005 (second place). He is also corecipient of the best paper award from the IEEE Journal of Solid-State Circuits for 2008. He is currently on the technical program committee of the IEEE RFIC Symposium. He has previously served as an Associate Editor of the IEEE Journal of Solid State Circuits, the IEEE Transactions on Circuits and Systems – Part 1, and the IEEE Transactions on VLSI Systems. He has also served as a Guest Editor of the IEEE Journal of Solid-State Circuits, and the IEEE Transactions on Microwave Theory and Techniques.