



Signal Processing Techniques for Energy and Spectrum Efficient Wireless Transmitters for 4G/5G Communication

(December 22-26, 2017)

Venue: Indian Institute of Technology Roorkee, Roorkee-247667, Uttarakhand, India

.....

Overview

This course focuses on investigating practical implementation hurdles of popular spectrum efficient techniques proposed for 4G/5G transmission and provide analog and digital signal processing solutions for power efficient operation of transmitters. Most of the 4G/5G techniques stress on spectrum efficiency such as carrier aggregation, multiple-input-multiple-output systems, high data-rate modulation techniques etc. However, Power efficiency is also another important parameters in designing communication systems, especially battery operated mobile terminals. In a typical transceiver, most of the power is dissipated in the power amplifier (PA) and consequently, it is very important to obtain the maximum efficiency from the PA. Unfortunately, moving to high throughput modulation schemes, for example, quadrature amplitude modulations (QAMs) such as 16-QAM and 64-QAM means that more envelope variation is needed to encode the information, and, consequently, due to PA nonlinearity signal distortion occurs. This course stresses on signal processing techniques as an effective method for the mitigation of the signal distortion due to transmitter nonlinearity. Moreover, this course stresses on the modern communication scenarios, such as, when transmitter system has to support several technologies such as 2G, 3G and 4G simultaneously. Due to different carrier frequencies, the multiband operation is required. Spectrum saving technique such as carrier aggregation also requires multiband operation in some cases such as intra-band carrier aggregation. Such multiband operation gives rise to distortion due to cross-modulation along with intermodulation distortion of PA. Similarly throughput-enhancing applications such as MIMO transmission have hardware limitation where linear and nonlinear crosstalk between MIMO signals adds to even more signal corruption. With so many distortion introducing elements in a practical transmission system, actual signal quality becomes very poor and does not derive complete benefits of many popular methods such as MIMO, carrier aggregation and multiband operations.

This course will provide state-of-the-art solutions for distortion control in such multi-channel transmission scenarios. As an advanced application, innovative techniques will be derived for filter-less, ultra-wideband communication.

Objective:

The primary objectives of the course are as follows:

- i) Exposing participants to the RF transmitter design constraints.
- ii) Create an understanding of such practical limitations in 4G/5G signal transmission

- iii) Establish the metrics to evaluate detrimental effects of such limitations.
- iv) Describe state-of-the-art digital and analog signal processing solutions.
- v) Provide understanding of comparative pros and cons of both the methods under defined requirements.
- vi) Case-study using data and devices from commercially available communication equipment.

Course Information	Duration: Dec. 22- Dec. 26, 2017
Modules	<p>Module 1: Transmitter design concepts and metrics</p> <p>Module 2: Overview of analog and digital signal processing solutions</p> <p>Module 3: Digital predistortion architectures for 4G/5G communication.</p> <p>Module 4: Extension of single-band case to multiple-input-multiple-output case.</p> <p>Module 5: Advanced techniques for signal quality improvement of transmitted data.</p> <p>Number of participants for the course will be limited to fifty.</p>
You Should Attend If...	<ul style="list-style-type: none"> ▪ You are an electronics engineer or research scientist interested in Transmitter designing. ▪ You are RF design engineer or research scientist interested in SDR design and Digital predistortion architectures for 4G/5G communication for defence and wireless industry. ▪ You are a student or faculty member from academic institution interested in learning algorithm of predistortion using CAD tools. ▪ You are RF design engineer or research scientist interested in hands-on training in Advanced techniques for signal quality improvement of transmitted data.
Fees	<p>The participation fees for attending the course is as follows:</p> <ul style="list-style-type: none"> • Participants from abroad: US \$500 • Industry/ Research Organizations: Rs. 15000.00 • Academic Institutions (Faculty): Rs. 7000.00 • Academic Institutions (Students): Rs. 5000.00 <p>➤ Students have to show the proof of their full time student enrollment in academic institute.</p> <p>The above fee include all instructional materials, computer use for tutorials and assignments, laboratory equipment usage charges, free internet facility.</p> <p>Fee does not include accommodation and food. On request basis, participants may be provided with accommodation on payment basis.</p> <p>Note: Accommodation: 1. The registration fee should be sent in advance through bank draft drawn in favor of "Dean SRIC, IIT Roorkee" and payable at Roorkee latest by Dec. 14, 2017. 2. The Complete form along with payment may please be sent to: Dr. Meenakshi Rawat, Department of Electronics and Communication Engineering, IIT Roorkee, Roorkee-247667, Uttarakhand, e-mail: karunfec@iitr.ac.in, karun.rawat.in@ieee.org</p>

The Faculty



Dr. Fadhel M. Ghannouchi has held numerous invited positions with several academic and research institutions in Europe, North America, and Japan. He has provided consulting services to a number of microwave and wireless communication companies. He is currently a Professor and the iCORE/Canada Research Chair with the Department of Electrical and Computer Engineering, Schulich School of Engineering, University of Calgary, Calgary, AB, Canada, and the Director of the Intelligent RF Radio Laboratory. He has authored or co-authored over 650 publications. He holds ten U.S. patents with five pendings. His current research interests include microwave instrumentation and measurements, nonlinear modeling of microwave devices and communications systems, the design of power and spectrum efficient microwave amplification systems, and the design of intelligent RF transceivers for wireless and satellite communications.



Dr. Meenakshi Rawat received the B.Tech. degree in electrical engineering from the Govind Ballabh Pant University of Agriculture and Technology, Uttarakhand, India, in 2006, and the M.Sc. and Ph.D. degrees in electrical and computer engineering from the University of Calgary, Calgary, AB, Canada, in 2012. From September 2012 to June 2013, she was a Post-Doctoral Research Fellow with the University of Calgary. From July 2013 to June 2014, she was a Post-Doctoral Project Researcher/Scientist with The Ohio State University. She is currently an Assistant Professor with the Indian Institute of Technology (IIT), Roorkee, India. Dr. Rawat was workshop co-chair for ARFTG-82 and session co-chair for MMwave and THz Designs for iMARC 2014, Bangalore, India. She was part of the Calgary group that won Overall Championship and Best Design Prize of the 3rd Annual Smart Radio Challenge, Wireless Innovation Forum. She was also the three-time recipient of the Research Production Award of the University of Calgary and Best paper award of the 82nd Automatic RF Techniques Group (ARFTG) Conference, Columbus, OH, USA, in 2013, and 83rd Automatic ARFTG Conference, Tampa, FL, USA, in 2014. She was listed as featured engineer on EEWeb (an electrical engineer community) in Feb. 2016.

Course Co-ordinator

Dr. Meenakshi Rawat

Phone: +91-1332-284830

E-mail: rawatfec@iitr.ac.in,
meenakshirawat@ieee.org

<http://www.gian.iitkgp.ac.in/GREGN>

Indian Institute of Technology Roorkee

Registration Form

**Signal Processing Techniques for Energy and Spectrum Efficient
Wireless Transmitters for 4G/5G Communication**

(MHRD Scheme on Global Initiative on Academic Network (GIAN))

December 22 - 26, 2017

- Name
- Designation
- Affiliation
- Address for Correspondence
-
.....
- Email:
- Phone No:
- Accommodation required: **Yes / No**
- Type: Hotel/Hostel/Guest House (accommodation shared basis may be available @Rs. 500/
per day)
- Cheque/DD No.
- Dated for Rs.

Date

Signature of the participant

Note:

1. The registration fee should be sent in advance through bank draft drawn in favor of "Dean SRIC, IIT Roorkee" and payable at Roorkee latest by Dec 7, 2017.

2. The Complete form along with payment may please be sent to:

Dr. Meenakshi Rawat, Department of Electronics and Communication Engineering, IIT Roorkee, Roorkee-247667, Uttarakhand, India, Ph.No.: (+91)- (0)1332-284808, e-mail: meenakshirawat@ieee.org, rawatfec@iitr.ac.in