Vogue Technologies on 5G & 5G+ Communication and Vehicular Technology

(26th December, 2017 – 2nd January, 2018)

Overview

A driving feature of future Internet architectures will be the mobile users. These mobile users increasingly will access information while on the move, whether attending a business meeting or working in remote locations or travelling in a vehicle. As the mobile Internet industry becomes ubiquitous and popular, the need for a high-data rate, large user capacity, lower latency, higher reliability, energy efficiency, etc, in wireless communication networks becomes an undisputed reality.

The past decade has seen many advances in wireless communication theory such as multiple input multiple output (MIMO), multi-user MIMO, Network MIMO, while Massive MIMO, mobile communication, underwater communication, cognitive radio, full-duplex radio, mmWave communications, etc have recenlty gain considerable research attention. While some of the technologies have been implemented in cellular systems such as LTE/LTE-A, others are being considered for 5G and 5G beyond. This course takes a unified view of the fundamentals of wireless communication and the recent developments and explains the concepts underpinning these advances at a level accessible to an audience with a basic background of digital communications.

Objectives

The primary objectives of the course are as follows:

- Exposing participants to the fundamentals of wireless communication techniques,
- Providing a deep understanding of advanced signal processing techniques associated with MIMO communications systems including array processing, beamforming, space-time coding, BLAST architectures, precoding technique and related information theoretic capacity limits.
- Providing the students with a clear idea of single-user, multi-user and multicarrier communications, single and multi-cell (including the emerging small cell architectures) and ad-hoc networks.
- Exposes the students to advance mobile communication techniques such as vehicular technology and its standards.
- Exposing the participants to emerging spectral efficient techniques such as IoT, cognitive radio, massive MIMO, mmWave, non-orthogonal multiple access communications and full-duplex radio.

Course Details	**Day 1:** Introduction to wireless communications and the wireless channel, Point-to-point communication: introduction to signal processing techniques for signal detection, source and channel coding, diversity and channel uncertainty, Cellular systems and vehicular technology: multiple access and interference management techniques **Day 2:** MIMO – diversity-multiplexing trade-off and Space-time codes, Massive MIMO and Multi-User MIMO, Massive MIMO and Cognitive radio **Day 3:** Array Signal Processing I, Introduction, Signal Model (1D and 2D or 3D arrays), Beamforming (Conventional, optimum and adaptive beamformers, Capon method, MSE based, beamforming, LCMV beamformers), Parasitic antenna array, lens array beamforming, Array Signal Processing II, Source Localisation (Conventional techniques, Subspace methods such as MUSIC, Root- MUSIC, ESPRIT), Array Signal Processing III, Detection of number of signals (MDL and AIC methods), Maximum Likelihood Parameter Estimation **Day 4:** Introduction to vehicular technology and mobile communication, Vehicle to vehicle (V2V) adhoc network and Time-variant channels, MIMO – spatial multiplexing, Multiuser capacity and space-time coding based techniques **Day 5:** Advanced topics – mmWave communications, non-orthogonal multiple access techniques (NOMA), IoT and Full-Duplex Radio **Day 6:** Examination or Project and Feedback.
You should attend if you are...	Engineers and researchers from manufacturing, service and government organizations including R&D laboratories. Students at all levels (BTech/MSc/M.Tech/PhD) or Faculty from reputed academic institutions and technical institutions. **Number of participants for the course will be limited to fifty.**
Registration Fees	The participation fees (Excluding Lodging & Boarding) for attending the course is as follows: Participants from Academic Institutions: Rs. 4,000 /- Persons from Industry/Consultancy firms: Rs. 10,000/- Participants from Abroad: USD 500 The above fee include all instructional materials, tutorials, assignments and internet facility. Fee does not include accommodation and food. On request, accommodation will be provided to the participants on payment basis. **The last date for registration is 15th December 2017**
How to Register ?	**Stage 1: Web (Portal) Registration:** Visit GIAN Website at the link: http://www.gian.iitkgp.ac.in/GREGN/index and create login user ID and Password. Fill-up blank registration form and do web registration by paying Rs. 500/- on line through Net Banking/ Debit/ Credit Card. This provides the user with life time registration to enrol in any no. of GIAN courses offered. **Stage 2**: **Course Registration (Through GIAN Portal):** Log in to the GIAN portal with the user ID and Password created. Click on "Course Registration" option given at the top of the registration form. Select the Course titled "Vogue Technologies on 5G & 5G+ Communication and Vehicular Technology" from the list and click on "Save" option. Confirm your registration by Clicking on "Confirm Course". Only Selected Candidates will be intimated through E-mail by the Course Coordinator. They have to remit the necessary course fee in the form of DD drawn in favour of "**The Director, NIT, Tiruchirappalli – 620015**" payable at **NIT-Tiruchirappalli**. The DD has to be sent to the Course Coordinator after registration.

Prof. Mathini Sellathurai - Course Faculty

Prof. Mathini Sellathurai is currently heading Electrical, Electronic and Computer Engineering Department and the Signal Processing for Intelligent Systems and Communications Research Group, Heriot-Watt University, Edinburgh, U.K and leading research in adaptive, cognitive and statistical signal processing techniques in a range of applications including Radar and wireless communications networks. She has been active in the area of signal processing research for the past 18 years and has a strong international track record in multiple-input, multiple-output (MIMO) signal processing with applications in radar and wireless communications research. Prof. Sellathurai has 5 years of industrial research experience. She held positions with Bell-Laboratories, New Jersey, USA and with the Canadian (Government) Communications Research Centre, Ottawa Canada. She is an Associate Editorship for the IEEE Transactions on Signal Processing and IEEE Signal Processing for Communications Technical Committee member. She was an organizer for the IEEE International Workshop on Cognitive Wireless Systems, IIT Delhi, India, 2009, 2010 and 2013; and the General Chair of the 2016 IEEE Workshop on Signal Processing Advances in Wireless Communications (SPAWC), Edinburgh, UK.. She is also a peer review college member of Engineering and Physical Sciences Research Council, UK.

Prof Sellathurai has published over 200 peer reviewed papers in leading international journals and IEEE conferences as well as a research monograph.. She was the recipient of the IEEE Communication Society Fred W. Ellersick Best Paper Award in 2005, Industry Canada Public Service Awards for her contributions in science and technology in 2005 and awards for contributions to technology Transfer to industries in 2004. Dr. Sellathurai was also the recipient of the Natural Sciences and Engineering Research Council of Canada's doctoral award for her Ph.D. dissertation Her research has been funded by UK Engineering Physical Sciences Research Council under EP/P009670/1 A Unified Multiple Access Framework for Next Generation Mobile Networks By Removing Orthogonality; EP/M014126/1 Large Scale Antenna Systems Made Practical: Advanced Signal Processing for Compact Deployments; EP/I037156/1 A Systematic Study of Physical Layer Network Coding: From Information-theoretic Understanding to Practical DSP Algorithm Design; EP/D07827X/1 advanced signal processing techniques for multi-user multiple-input multiple-output broadband wireless communications; EP/G026092/1 Bridging the gap between design and implementation of soft-detectors for Turbo-MIMO wireless systems; EP/H012257/1 Signal Processing Techniques to Reduce the Clutter Competition in Forward Looking Radar.

Prof. T. Ratnarajah (Course Faculty) is currently with the Institute for Digital Communications, the University of Edinburgh, Edinburgh, UK, as a Professor in Digital Communications and Signal Processing and Head of Institute for Digital Communications. Prof Ratnarajah is an internationally renowned research scholar and working in the area of wireless communications, signal processing, information theory and random matrix theory research for the past 23 years and has an outstanding international track record and reputation for his research in this field, as recognized by over 300 peer reviewed papers and four US patents.

He was the coordinator of the P7 ADEL (3.7M€) in the area of licensed shared access, FP7 Future and Emerging Technologies projects "CROWN" (http://www.fp7-crown.eu/, 2.3M Euros) in the area of cognitive radio networks, "HIATUS" (http://www.fp7-hiatus.eu/, 2.7M Euros) in the area of interference alignment and FP7 project "HARP" (http://www.fp7-harp.eu/, 3.2M Euros) in the area of highly distributed MIMO.

Dr. G.Lakshminarayanan is an Associate Professor in the Department of Electronics and Communication Engineering at NIT-Trichy, India. His research interests are primarily in the areas of High performance Digital VLSI Architectures, VLSI based Wireless System Design/Physical Layer Design and Algorithms & Techniques for Cognitive Radio. He is currently the head of the department of Electronics and Communication engineering in National Institute of Technology, Tiruchirappalli. He is carrying out research work in VLSI Signal Processing and FPGA based Wireless Transceivers.

Dr. B Venkataramani is a Professor in the Department of Electronics and Communication Engineering at NIT-Trichy, India. His research areas include analog circuit design, RF front end tranceiver design. He has also served as HOD of ECE department and dean of research and consultancy of NIT trichy. He has carried out several projects funded by DST, SMDP, DeitY, MHRD.

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