SIGNAL PROCESSING FOR MM WAVE COMMUNICATION FOR 5G AND BEYOND

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PRE-REQUISITES : Minimum: BE (ECE)

INTENDED AUDIENCE : BTech final year, M.Tech students (enrolled or passed out), any employee of an organization which is involved in Physical layer (4G/5G) algorithms development

INDUSTRIES APPLICABLE TO : Qualcomm Ltd., Mediatech Communication Private Ltd

COURSE OUTLINE :

Due to significant tele-traffic growth in forthcoming 5G technology, it is essential to increase the service bandwidth and transmission radio frequency to millimeter wave. This comes with its own set problems due to higher path loss and other issues. This course encompasses the complete mmWave communication from the signal processing point of view. In this course, we will cover mmWave channel models, MIMO-OFDM in mmWave and Beamforming technology. We will also cover a rigorous MATLAB simulation to understand mmWave beamforming with MIMO-OFDM.

ABOUT INSTRUCTOR :

Prof. Amit Kumar Dutta is currently an Assistant Professor at the GS Sanyal School of Telecommunication of IIT Kharagpur. Before this academic position, He worked in various corporate like Texas Instrument, Broadcom Ltd, Cypress Semiconductor, NxP Ltd for almost 14 years in the field of signal processing and communication. He has a vast knowledge of practical implementation of DSP/Modem system. His current research interest includes mmWave/THz signal processing and communication, Quantum signal processing, VLSI for communication.

COURSE PLAN :

Week 1: Wireless Channel–A ray tracing model-Part-I (With an outline on modern modem structure)

Week 2: Wireless Channel–A ray tracing model-Part-II

Week 3: Understanding of various channel related parameter statistics. Narrow band and broadband aspect

Week 4: mmWave channel model

Week 5: Understanding angle of arrival (AoA) and angle of departure (AoD) concept, understanding channel gain,

Week 6: Introduction of single antenna beamforming in mmWave, an antenna array processing concept.

Week 7: Details of beamforming in mmWave: Concept of antenna many fold vector, beam parameters, efficiency of beams pattern

Week 8: Hybrid beamforming concept. Beamforming in MIMO system Part-I (Precoder, phase shifter, equalizer concepts)

Week 9: Hybrid beamforming concept. Beamforming in MIMO system Part-II (Optimization of design parameters)

Week 10: MIMO-OFDM with mmWave beamforming

Week 11: Parameter estimation in mmWave system (Mainly LMMSE based)

Week 12: Introduction of impairments and a basic analysis in mmWave system