



PRINCIPLES OF MODERN CDMA/ MIMO/ OFDM WIRELESS COMMUNICATIONS

PROF. ADITYA K. JAGANNATHAM

Department of Electrical Engineering
IIT Kanpur

PRE-REQUISITES: Basic knowledge of - Probability, random variables, Digital modulation, BPSK, QPSK etc

INTENDED AUDIENCE: The intended audience is students, practicing engineers, technical and non-technical managers of telecom companies, students preparing for competitive exams with communication engineering subject

INDUSTRY SUPPORT: Most companies in the wireless communications area should find this useful. Examples are Qualcomm, Broadcom, Intel etc.

COURSE OUTLINE :

The field of wireless communications has witnessed revolutionary technology developments in the last decade. While previously there existed only 2G GSM based communication systems which supported a data rate of around 10 Kbps, several radical wireless technologies have been developed in the last 10 years to enable broadband wireless access with rates in excess of 100 Mbps. These have subsequently led to the development of 3G and 4G wireless technologies such as HSDPA (High Speed Downlink Packet Access), LTE (Long Term Evolution) and WiMAX (Worldwide Interoperability for Microwave Access). This has been made possible through breakthrough wireless technologies such as Code Division for Multiple Access (CDMA), Orthogonal Frequency Division Multiplexing (OFDM), Multiple Input Multiple Output (MIMO). These techniques form the basis of understanding the world of 3G/4G wireless communication systems. This course will present an elaborate introduction to the principles and performance of these fundamental 3G/ 4G wireless technologies

ABOUT INSTRUCTOR:

Prof. Aditya K. Jagannatham received his Bachelors degree from the Indian Institute of Technology, Bombay and M.S. and Ph.D. degrees from the University of California, San Diego, U.S.A. From April '07 to May'09 he was employed as a senior wireless systems engineer at Qualcomm Inc., San Diego, California, where he was a part of the Qualcomm CDMA technologies (QCT) division. His research interests are in the area of next-generation wireless cellular and WiFi networks, with special emphasis on various 5G technologies such as massive MIMO, mmWave MIMO, FBMC, NOMA, Full Duplex and others. He has contributed to the 802.11n high throughput wireless LAN standard and has published extensively in leading international journals and conferences. He was awarded the CAL(IT)2 fellowship at the University of California San Diego and the Upendra Patel Achievement Award at Qualcomm.

He is currently a Professor in the Electrical Engineering department at IIT Kanpur, where he holds the Arun Kumar Chair Professorship, and is also associated with the BSNL-IITK Telecom Center of Excellence (BITCOE). He has been twice awarded the P.K. Kelkar Young Faculty Research Fellowship for excellence in research, the Qualcomm Innovation Fellowship (QInF) and the IIT Kanpur Excellence in Teaching Award. His popular video lectures for the NPTEL (National Programme on Technology Enhanced Learning) course on Advanced 3G and 4G Wireless Mobile Communications can be found at the following YouTube link (NPTEL 3G/4G). He has also successfully conducted several Massive Open Online Courses (MOOCs) on various topics such as Applied Game Theory, MIMO OFDM Wireless Systems, Probability and Random Processes, Signals and Systems, Principles of Communication Systems, which have been widely adopted and appreciated. A book authored by him titled Principles of Modern Wireless Communications Systems has been published by McGraw Hill Education and comprehensively covers several key aspects of modern wireless technologies.

COURSE PLAN :

- Week 1-** Introduction to Wireless Systems
- Week 2-** Performance in Fading wireless channels
- Week 3-** Multiple Antenna Wireless Systems and Diversity
- Week 4-** Wireless Channel Characterization - Delay Spread and Doppler
- Week 5-** Principles of CDMA Wireless Communication
- Week 6-** Principles of MIMO Wireless Communication
- Week 7-** Principles of MIMO Wireless Communication (Continued)
- Week 8-** Principles of OFDM Wireless Communication