

**Tutorial Proposal for ISSSTA '04**  
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**Title: OFDM – Choice of Next Generation Wireless Communication**

**Abstract:**

The Orthogonal Frequency Division Multiple (OFDM) access schemes have been gaining a lot of attention for next generation of mobile communication systems because of its immunity to the multipath interference and effective spectrum utilization. The successful adaptation of the OFDM access scheme for European Digital Audio Broadcasting (DAB) and Digital Video Broadcasting (DVB) systems have catapulted this as a forerunner for the 4<sup>th</sup> generation of wireless communication systems and have already been adapted for the high data rate IEEE 802.11a/g and HiperLan2 Wireless Local Area Network (WLAN) applications. This tutorial will cover the basic principles and characteristics of OFDM systems. The problems and some of the potential solutions to the practical issues in implementing such a system will be presented. These include but not limited to time and frequency synchronization, channel estimation, channel equalization and techniques for peak-to-average power ratio reduction. Finally, we conclude the tutorial with an example of a real wireless OFDM transceiver design.

1. Introduction
  - Historical Prospective of Wireless Communications
2. Wireless channel Impairments
  - Multipath Fading
  - Diversity Scheme
3. Digital Modulation Scheme
  - Performance characterization of Digital Modulation
  - Probability of Error formulation
4. Interference
  - Co-channel
  - Adjacent Channel
5. Multiple Access Scheme
  - FDMA, TDMA, CDMA
6. Multicarrier Concept
  - Issues and evolution of OFDM systems
7. OFDM
  - Basic concepts (FFT/IFFT Transceiver formulation)
  - Characterization with respect to impairments (especially multipath fading)
  - Inter-Symbol Interference mitigation (use of Guard period)
  - Inter-Carrier Interference mitigation (use of Cyclic Prefix)

- Effect of RF and Front-End Nonlinearities and Impairments (Frequency, Phase, Time offsets)
  - Peak-to-average Power ratio issues and mitigation
  - Frequency, phase and channel estimation and tracking
    - o Use of preamble sequences and pilot for decision aiding
  - Joint Estimation Techniques
8. Diversity Techniques for OFDM
- Antenna Diversity
  - MIMO
9. Applications
- WLAN 802.11a Systems
10. References
11. Discussion

### **Biography of Author:**

Dr. Jha has over 25 years of industry experience specializing in the wireless/cellular systems architecture and systems engineering. Uma is currently the Chief Mobility Architect at Boeing. Prior to this he was the Chief Technology Officer (CTO) of Airify Communications, a venture backed wireless router company engaged in building the universal wireless platform unifying the WWAN, WLAN and WPAN wireless/cellular systems with seamless access/connectivity to the mobile users based on price, access and throughput requirements. Uma has served as the Director of Systems Engineering at Morphics Technology, Manager at Philips Semiconductors and Systems Staff Engineer at Conexant to name a few. He received his BSEE from BIT Sindri, MSEE from CSU, Fullerton, Engineer degree from USC, Los Angeles and Ph.D. degree from university of Aalborg, Denmark. Dr. Jha is a senior member of IEEE. Dr. Jha has been invited to deliver tutorials on Cellular Systems, 3G-WCDMA, OFDM and other cellular/wireless topics all around the world. He has served on NesCom IEEE Standards board including the chairperson and panelists for many conferences and has several publications and key patents in the area of wireless/cellular systems. Uma is on the editorial board of Wireless Personal Communication magazine published by Kluwer publication. He has served on many Technical Program committees such as VTC-2003, VTC-2002, WPMC-2002, WPMC-2001 and ICPWC-2000.