Offering: Winter 04

Instructor: Sumit Roy

Course Objectives

The course is intended to a) provide an introduction to spread-spectrum communication fundamentals and its applications to mobile communications and b) describe recent advances in the context of next generation (3G and beyond) cellular system designs based on CDMA. The latter part of the course will indicate ongoing research issues in this area for possible investigation via the class project.

Course Outline

• Fundamentals of Spread-Spectrum & Cellular Communications
  i. Multiple Accessing Principles: Direct Sequence, Frequency Hopping
    - Shannon Capacity (TDMA, FDMA and Spreading)
    - Design of SS code sequences (long and short spreading codes)
  ii. Key Elements of Cellular Organization
    - Frequency Reuse (FDMA/TDMA)
    - Uplink/Downlink System Capacity & Design Objectives
    - Intra-cell vs. Inter-Cell Interference
  iii. Performance Analysis of CDMA and FH Systems: Receiver Design
    - Multi-User (Multiple Access) Interference
    - Jamming, Narrow Band Interference
    - Matched Filter vs. Multi-User Detection
  iv. Acquisition of DS-SS signals
    - Serial and Parallel Search Approaches
  v. Performance in Multipath Fading Channels
    - RAKE receiver: Path Tracking & Channel Estimation

• Advanced CDMA System Design Concepts (3G & Beyond)
  i. Multi-carrier and Wideband CDMA
    - High Data Rate System Optimization & Trade-offs
  ii. Direct Sequence Ultrawideband Communications
    - Ultra Low Power, Short Range system optimization and trade-offs

Prerequisites: EE505, 506 or equivalent

Assessment:
The overall grade will be based on:

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(i) 4-5 Homework assignments [35%], (ii) Mid-term Exam [25%] and (iii) Class Project [40%]

Class projects will be conducted by teams of 2 students and will require: (i) An initial proposal, (ii) Conducting analysis and simulations and (iii) A written final report describing the results.

Text

Additional References

*Fundamentals of Spread Spectrum*


*CDMA System Designs (2G, 3G etc.)*

- L. Hanzo “MC-CDMA and OFDM: