Title
Single Channel Estimation Algorithm for Acoustic OFDM Communication Systems

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Single Channel Estimation Algorithm for Acoustic OFDM Communication Systems

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Acoustic Testbed for Network/Communication Applications

Motivation

• Inexpensive, easy to program wireless communications infrastructure
• Used to validate algorithms for a variety of wireless communication environments
  – point to point cellular communications
  – cooperative communications
  – multiple-input/multiple-output systems
  – underwater acoustic communication
  – ultrawideband communication

Hardware Specifications

• M-Audio Delta 1010 24 bit 96 kHz Digital Recording System
• SM Pro Audio PR8-MK2 8-channel mic-line preamp
• Behringer Studio C-2 Condenser microphones
• PC with Matlab/Simulink and speakers

State of Development: Orthogonal Frequency Division Multiplexing Point-to-Point Link

OFDM Communication

• Cyclic Prefixes
  – A segment from the end of data, whose length is longer than the channel impulse response, is repeated at the beginning, thus eliminating the effects of intersymbol interference (ISI)
• Orthogonality of Sub-Carriers
  – OFDM uses multiple carrier frequencies simultaneously; since they are orthogonal to each other, there is no interference from adjacent subcarriers. This efficiently uses the available bandwidth.

Channel Modulation Experiment

• OFDM Modulator
  – Messages created by randomly generated QPSK symbols
  – Signal sent over 2048 subcarriers
  – Cyclic prefix 512 samples long
  – Suppression carrier 200 samples long
• Start of Frame Detector
  – OFDM block synchronization algorithm evaluates the autocorrelation between two sequences to determine the start of the message
• OFDM DeModulator
  – Received signal compared with original message to create frequency channel response

Experiment Results

Experiments performed at USC's UlTra Lab
Sampling Rate - 22050 Hz
Baud Rate – 2000 symbols/sec
Carrier Frequency – 5000 Hz

Frequency Response over Time