

Synchronisation

SYLLABUS

Single Carrier Modulation Review

- Amplitude, Frequency and Phase Shift Keying
- Quadrature Amplitude Modulation
- Complex Representation of QAM
- Constellation Diagrams
- Pulse Shaping
- Matched Filtering
- Effect of Synchronisation Errors
- Inter-Symbol Interference
- Eye Diagrams

Single Carrier Synchronisation

- Maximum Likelihood Parameters Estimation
- Open Loop Techniques
- Closed Loop Techniques
- Carrier Frequency Recovery
- Band Edge Filtering
- Carrier Phase Recovery
- Phase Locked Loops (PLLs)
- Squaring Loops
- Costas Loops
- Symbol Timing Recovery
- Delay Locked Loops (DLLs)
- Coherent and Non-Coherent Techniques
- Decision Directed Techniques
- Non-Decision Directed Techniques
- Signal Acquisition
- Frame Synchronisation
- Exploiting Pilot Symbols

Signal Resampling

- Multi-Rate DSP Review
- Decimation
- Interpolation
- Resampling by Non-Integer Factors
- Polyphase Filter Decomposition
- Polyphase Implementation
- Sinc Interpolation
- Variable Delay FIR Filter
- Farrow FIR Structure

Propagation Channels

- Additive White Gaussian Noise Channels
- Multipath Propagation
- Delay Spread
- Coherence Bandwidth
- Coherence Time
- Fading Environments
- Baseband Channel Modelling

Direct Sequence Spread Spectrum Synchronisation

- Direct Sequence Spread Spectrum Review
- Channelisation and Scrambling
- Spreading Gain
- Pilot Channels
- Multipath Resolution
- Channel Estimation
- Delay-Locked Loops
- RAKE Receiver Structure

OFDM Synchronisation

- OFDM Signal Structure
- OFDM Modulation using the IFFT
- Cyclic Prefix / Guard Interval
- Bandwidth Control through Windowing
- Oversampling
- Sensitivity to Synchronisation Errors
- Inter-Carrier Interference
- Carrier Frequency Offset
- Symbol Timing Recovery
- Frequency Domain Equalization
- Effects of Phase Noise
- Exploiting the Cyclic Prefix
- Utilising OFDM Pilot Sub-Carriers

Equalisation

- Adaptive Filtering
- Linear Equalisation
- Decision Feedback Equalisers
- Fractionally Spaced Equalisers
- The Viterbi Equaliser

Case Studies:

- 3G (WCDMA)
- Initial Timing Synchronisation Procedure
- Timing Refinement using DLLs
- Coherent Demodulation using Continual Pilot

- Bluetooth (GFSK / DQPSK)
- Signal Acquisition
- Preamble Correlation
- Frequency Recovery
- Timing Recovery

- Wi-Fi 802.11 (OFDM)
- Structure of Training Symbols
- Signal Acquisition
- Coarse and Fine Frequency Estimate
- Channel Estimation
- Frequency Tracking