Signal Processing with MATLAB

Prerequisites

MATLAB Fundamentals or equivalent experience using MATLAB, and a good understanding of signal processing theory, including linear systems, spectral analysis, and filter design

Day 1 of 2	
Signals in MATLAB	**Objective:** Generate sampled and synthesized signals from the command line and visualize them. Create noise signals for a given specification. Perform signal processing operations like resampling, modulation, and correlation. Creating discrete signals Sampling and resampling Visualizing signals Modeling noise Performing resampling, modulation, and correlation Generating streaming signals
Spectral Analysis	**Objective:** Understand different spectral analysis techniques and the use of windowing and zero padding. Become familiar with the spectral analysis tools in MATLAB and explore nonparametric (direct) and parametric (model-based) techniques of spectral analysis. Discrete Fourier transform Windowing and zero padding Power spectral density estimation Time-varying spectra Using a spectrum analyzer in MATLAB
Linear Time Invariant Systems	**Objective:** Represent linear time-invariant (LTI) systems in MATLAB and compute and visualize different characterizations of LTI systems. LTI system representations z-transform Frequency and impulse response Visualizing filter properties Applying filters to finite and streaming signals

Day 2 of 2	
Filter Design	**Objective:** Design filters interactively using the Filter Design and Analysis app. Design filters from the command line using filter specification objects. Filter specifications Interactive filter design Common filter design functions Filter design with filter specification objects Reducing filter delay Frequency-domain filtering

The Signal Analysis App	**Objective:** Learn to use a powerful all-in-one app for importing and visualizing multiple signals, performing spectral analysis on them, and designing and applying filters to the signals. Make simple statistical and cursor measurements on signals. Browse signals and make simple measurements Perform interactive spectral analysis Design and apply filters to signals interactively
Multirate Filters	**Objective:** Understand principles of polyphase multirate filter design. Design multirate interpolating and decimating filters. Design multistage and narrow-band filters. Downsampling and upsampling Noble identities and polyphase FIR structures Polyphase decimators and interpolators Design multistage and interpolated FIR filters
Adaptive Filter Design	**Objective:** Design adaptive filters for system identification and noise cancellation. Basics of adaptive filtering Perform system identification Perform noise cancellation Improve adaptive filter efficiency