Course ID
SIGPROC
Course Duration
4 days

Course Title
Signal Processing Concepts for Communications System Analysis and Design

Aimed At

This course is aimed at those in the industry or government whose work involves the analysis or design of modern communications systems.

Group Size

5-25

Prerequisites

A Bachelor's degree in Science, Mathematics, or Engineering or equivalent work experience.

Course in a Nutshell

This important course brings together, in one place, signal processing concepts as well as mathematical techniques that are critical for understanding and effectively analyzing or designing the modern communications systems. It's a great introduction to the subject for those who may not have been exposed to this material and an excellent refresher for those who learned it long time back in college. Both types of audiences will benefit from this course's practical, application-centered instructional approach aimed at bridging the gap between theory and application. This course is a must for all whose work focuses on the analysis or design of existing or emerging communications systems.

Customize It!

Depending on the participants' knowledge of the prerequisites and the topics covered, this course can be extended to five days or shortened to three days. It can also be modified to cover additional topics that may be relevant to your project needs.

Course Outline

- Discrete Time Signal Processing
  - Sampling Theorem: Continuous and Discrete time
  - Interpolation and Up sampling
  - Decimation and Down sampling
  - ADC and DAC Convertors
  - Overview of Transforms
  - Convolution Operation
  - IIR and FIR Filter Structures
    - Pole-Zero Representations

- Fourier and Z Transforms
  - Power Spectral Density (PSD)
  - Linear Filtering
  - Discrete Fourier Transforms (DFT)
  - FFT and IFFT
- Probability Overview
  - Mean, Variance, Several Theorems
  - PDF Examples: Gaussian, Erlang, Exponential, Uniform, etc.
  - Central Limit Theorem
  - Hypothesis Testing (MAP, ML)
  - Calculating Probability of Error
    - Digital Communications Systems Example
  - The importance of the PDF and CDF
- Linear Algebra Methods
  - Dot Product and Cross Product
  - Matrix Inversion
  - Eigen Decomposition
- Adaptive Signal Processing
  - Minimum Mean Square Error (MMSE)
  - Least Mean Squared (LMS) and NLMS
  - Recursive Least Squared (RLS)
  - Direct Matrix Inversion (DMI)
  - Maximum Likelihood Estimation (MLE)
  - Interpolation Techniques (Lagrange, Linear)
- Equalization Methods
  - Decision Feedback Equalization (DFE)
  - Maximum Likelihood Sequence Equalizer (MLSE)
- Communications Applications
  - DC Offset Estimation
  - Automatic Frequency Correction (AFC)
  - Channel Estimation
  - Likelihood Ratio Testing
  - Phase Noise
- Estimators
  - Properties of Estimators
  - Digital Communications Application (BER)
- Wrap-up
  - Course Recap and Q/A
  - Evaluations

How You Will Learn

- A highly experienced subject matter expert, involved in the analysis and design of state-of-the-art communications systems, will present this course in interactive lecture format.
- Along with the lecture, we will use examples and exercises to enrich the instruction and drive home the essential points.
- If you already know something about the concepts and techniques taught in this course, we will build on that knowledge base.
- If your background is less technical, we will use examples and analogies to simplify the complex subject matter.
- You will receive a printed Participant Handbook which will help you remember and retain what you learned in class and apply it on your job.

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