DSP Primer

HDT-DSPPRI-100-ILT v1.00

Course Description

This course provides a foundation for Digital Signal Processing theory to serve as either a refresher or as an introductory course. The course begins with basic signal processing concepts and terminology. The body of the course explores filtering concepts and techniques, convolutions, and transforms. Although the course is theoretical in nature, factors relevant to efficient implementation in hardware are explored. The concepts that are introduced are complemented by several hands-on exercises to reinforce the concepts learned.

Level – Beginner
Course Duration – 3 days
Price – $2100 or 21 Training Credits
Course Part Number – HDT-DSPPRI-100-ILT
Who Should Attend? – Engineers and designers who have an interest in Digital Signal Processing Theory and are seeking to refresh their knowledge or explore the concepts of DSP through an introductory theory course.
Prerequisites

- None

Software Tools

- MATLAB® 2009b

Hardware

- None

Course Outline

Day 1

- **Back to Basics** – Introduces basic concepts and origins of signal processing, quantization, sampling theory and methods, fixed point and floating point numbers.
- **Linear Systems** – Discusses the requirements and special properties of linear systems. Comparison of linear systems and non-linear systems.
- **Filtering** – Introduces basic concepts of filtering, filter classification, and different filter types, including Butterworth, Chebyshev, Elliptic, and Bessel filters.
- **Exercise 1 –** Basic Concepts, Linear Systems, and Filters

Day 2

- **Digital Filters** – Discusses the advantages and requirements of digital filters. The FIR filter is introduced and discussed in detail.
- **Advanced Digital Filters** – Introduces comb filters and IIR filter techniques. Compares FIR and IIR filter techniques. Discusses noise in filter designs and adaptive filters.
- **Convolution** – Introduces concepts and properties of convolution. Introduces the Delta function and impulse response. Discusses common impulse responses and mathematical properties.
- **Exercise 2 –** Digital Filters
- **Exercise 3 –** Convolution

Day 3

- **Discrete Fourier Transforms** – Discusses periodic signals, properties and concepts of the DFT, Inverse DFT, and practical considerations.
- **Fast Fourier Transforms** – Introduces the FFT, function and operation. Discussion of FFT in comparison to the DFT. Brief discussion of FFT convolution and complex FFT. Introduces Fourier Transform pairs.
- **Continuous Signal Processing** – Discusses approximations and limitations of continuous signal processing. Examines the Delta function, convolutions, and FFTs as applied to continuous signals.
- **Hardware Design Considerations** – Discusses the advantages and disadvantages of various hardware implementation architectures and strategies. Relates hardware architectural features to mathematical theory of operation. Discussion of Filter and Fourier Transform operation, and performance vs. precision tradeoffs. Examines memory usage and limitations in practical hardware applications.
- **Exercise 4** – Fourier Transforms
- **Exercise 5** – Hardware Architecture and Design Considerations

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Chris Green
Email: **training@hardent.com**
Telephone: **514-999-3880**