DSP: Digital Signal Processing

Course No. 199

FOR WHOM INTENDED Digital signal processing (DSP) is one of the fastest-changing fields in modern electronics. Individuals who obtained their education and training just a few years ago, need their skills updated to prepare for the continuing explosion of DSP technology. The course is applicable to technicians and engineers employed in a wide range of industries.

BRIEF DESCRIPTION OF COURSE This course is an introduction to DSP concepts and implementation. It starts by explaining the need for digital signal processing and DSP systems. A complete model of a DSP system is examined from the input transducer, through all the stages including: signal conditioning, anti-aliasing filter, analog-to-digital and digital-to-analog conversion, output smoothing filter, and output transducers. Real life examples will be used to illustrate the use and need for each part of a DSP system.

Understanding how numbers are processed in a DSP application is key in their use and application. All the key areas needed to understand number processing are covered in this course.

Correct acquisition of the signal is absolutely necessary for proper use of digital signal processing. Sampling theory, sample resolution and anti-aliasing filters are explored with real examples to illustrate this important area of DSP.

Application examples are examined to give the student a good understanding of what's needed to apply DSP techniques to new areas. DSP tools are demonstrated to illustrate the tools available needed to apply DSP techniques.

The instructor covers the how, where, why and when of DSP applications. Electronics are rapidly changing the way DSP is applied and the techniques used to solve problems. Successful completion of this course will assist the participants to apply the latest techniques to their everyday projects.

CERTIFICATE PROGRAMS This course is a recommended elective for TTi's Instrumentation Test Specialist (ITS) Certificate Program, and may be used as an elective for any other TTi specialist certificate program.

PREREQUISITES There are no definite prerequisites for this course, but TTi's Course 163 "Instrumentation for Test and Measurement" or Course 164 "Instrumentation for Electrical Test and Measurement" would be helpful.

TEXT Each participant will receive a course workbook, including most of the viewgraphs used during the presentation.

COURSE HOURS, CERTIFICATE AND CEUs Open courses meet seven hours per day. Upcoming presentation dates can be found on our current open course schedule. Class hours/days for on-site courses can vary from 14–35 hours over 2–5 days as requested by our clients. Upon successful course completion, each participant receives a certificate of completion and one Continuing Education Unit (CEU) for every ten class hours.

For schedules, general information and registration forms, see TTi's web site.

Course Outline

Digital Signal Processing and DSP Systems
Need for DSP • Advantages of DSP
Characteristics of DSP Systems

A Model of a DSP System
Input • Signal Conditioning • Anti-Aliasing Filters
Analog-to-Digital Converter • Processor
Digital-to-Analog Converter • Output Smoothing Filter
Output Transducer • DSP Processors • DSP Format Types
Alternative Formats for Commercial DSP Processors

How Numbers are processed in a DSP
Polynomials • Transcendental Functions • Series Expansions
Limits • Integration • Oscillatory Motion • Complex Numbers

Acquisition of the Signal
Sampling Theory • Sampling Resolution
Aliasing • Reconstruction

Application Examples—Anti-Alias Filters
Filtering • Sample Filter
Types of Filters
- Bessel
- Butterworth
- Elliptical

Fourier Series
Insights to be gained from Fourier Series
Nyquist Frequency

Orthogonality and Quadrature
Orthogonality—Basic Building Blocks of DSP
Quadrature—Signals 90 degrees out of phase with each other

Transforms
The Z-Transform • DFT—Discrete Fourier Transform
Laplace Transform

Finite Impulse Response Filter—FIR
What is it? • Stability • Cost
Design Methodology • Design Examples • Convolution

Infinite Impulse Response Filter—IIR
What is it? • Stability • Cost
Design Methodology • Design Examples

DSP Tools
Programming Languages • Mathematical Tools
Special Purpose Tools • Development Packages

DSP and the Future
New Uses • DSP Directions • Future Technologies

Summary, Final Quiz

Award of Certificates for Successful Completion

Technology Training, Inc.
(a tti group company)
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