
PRACTICAL DIGITAL SIGNAL PROCESSING FOR ENGINEERS AND TECHNICIANS



THIS WORKSHOP WILL OFFER YOU:

- A clear understanding of Digital Signal Processing (DSP)
- Benefits and application of DSP technology to improve efficiency
- Frequency analysis of signals and the application of this knowledge
- Information about and actual design of digital filters
- Analysis of the performance of DSP systems
- Identification of the key issues in designing a DSP system
- An understanding of the features and capabilities of commercial DSP applications
- Current DSP technology

WHO SHOULD ATTEND:

- Communication System Engineers
 - Electrical and Electronic Engineers
 - Control System Engineers
 - Instrumentation Engineers
 - Electrical and Electronic Technicians
 - Design Engineers
 - Condition Monitoring Engineers and Technicians
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The Workshop

Digital Signal Processing (DSP) is the capture, analysis and manipulation of an analogue signal by a digital computer. The integration of DSP software and hardware into products across a wide range of industries has necessitated the understanding and application of DSP by engineers and technicians.

Workshop Objectives

The introduction of DSP from a practical point of view using a minimum of mathematics. The emphasis is on the practical aspects of DSP, implementation issues, tips, tricks and pitfalls, and practical applications. Intuitive explanations and appropriate examples are used to develop a fundamental understanding of DSP theory. The workshop participant's will gain a clear understanding of DSP technology in a variety of fields from process control to communications.

Some of the DSP techniques included in the workshop:

- Digital filtering for cleaning a signal from noise
- Discrete Fourier Transforms for finding a particular frequency component
- Correlation techniques to find a signal buried in noise
- Industrial control with digital controllers
- Instrumentation and test for better accuracy
- Vibration analysis for identifying frequency signatures
- Image and video processing for enhancing images
- Communications especially for filtering out noise

Practical Sessions

There are eight practical sessions designed to enhance the delegate's understanding of the workshop. Most are software-based and make use of the widely used MATLAB software from Mathworks, Inc. Other sessions use the Texas Instrument DSP boards for experimentation.

- Introduction to MATLAB/SIMULINK and Signal Processing Toolbox
- Introduction to SIMULINK
- FIR Filter Design
- IIR Filter Design
- Filter Realisation
- Image Processing
- Sampling and Quantisation
- DSP Implementation

The Program

INTRODUCTION

- Terminology and motivation
- Why process digitally?
- A typical DSP system
- Some current application areas

DIGITAL-TO-ANALOG AND ANALOG-TO-DIGITAL CONVERSION

- Periodic sampling and aliasing
- Digital to analog converters
- Analog reconstruction
- Analog to digital converters

DISCRETE SIGNALS AND SYSTEMS

- Discrete-time signals: notation and representation
- Classification of discrete systems
- The concept of impulse response
- The concept of convolution
- Autocorrelation and cross-correlation of signals

Practical Session

FREQUENCY ANALYSIS OF DISCRETE SIGNALS

- Fourier series for periodic signals
- Discrete Fourier Transform (DFT) for non-periodic signals
- Understanding the DFT equation
- DFT properties
- The Inverse DFT
- The Fast Fourier Transform (FFT)
- Frequency analysis of discrete signals: use of windows and DFT results interpretation
- Fast computation of convolution using DFT
- Other related transforms

Practical Session

DSP APPLICATION EXAMPLES

- Digital waveform generators
- Speech modelling and synthesis
- Noise reduction and signal enhancement
- Image restoration
- Communications system

Practical Session

IIR DIGITAL FILTER DESIGN

- Review of classical filter approximation techniques
 - Characteristics of IIR filters
 - Design methods
 - Design examples
- Practical Session

FIR DIGITAL FILTER DESIGN

- Characteristics of FIR filters
 - Design methods
 - Design examples
- Practical Session

DIGITAL FILTER REALISATIONS

- Direct form
 - Hardware realisations
 - Quantisation effects
- Practical Session

COMMERCIAL DSP HARDWARE

- Architectural difference between DSP chips and general purpose microprocessors
 - Texas Instrument TMS320 family
 - Motorola DSP56000 family
 - Analog Devices ADSP-2100 family
 - Choosing a DSP architecture
 - DSP trends
- Practical Session

PRACTICAL TOOLS FOR DSP SYSTEM DEVELOPMENT

- Simulation tools for algorithm development
 - Software development tools
 - Hardware development tools
- Practical Session