Digital Signal Processing Courses

Why not bring our Digital Signal Processing (DSP) programming expertise to your team with one of our bespoke DSP courses. Numerix has been providing DSP courses for industry and research organizations for over 25 years.

We are very experienced at presenting to attendees with a wide level of abilities and previous knowledge of DSP. We can cater for beginners and experts, all on the same course and can tailor modules to suit the attendees.

Our DSP courses start off with an introduction to the theory of DSP but they are targeted at the practicing engineer so the complexity of the underlying mathematics is kept to a minimum to allow the attendees to understand the practical details. We bring years of real DSP experience to these courses and one of the main benefits of this is that we know what is important and what is not, when it comes to designing DSP systems.

Our most popular course is a 3 day on-site introduction to DSP theory and implementation, with each day combining 4 tutorial modules of 1.5 hours. We also offer a 4 day course, with the additional day split equally between additional hands-on laboratory sessions and additional classroom lectures that focus on specific areas from earlier in the course. The basic 3 day course schedule is laid out below and modules can be swapped for the additional modules listed below.

Day 1

Introduction to DSP theory

What is DSP, Advantages and disadvantages
Fundamental signals and operations
Linear Time Invariant (LTI) systems
Difference equations and z-transforms

Convolution correlation and Finite Impulse Response (FIR) digital filtering

Convolution
How FIR filters work
FIR Filter design techniques - Linear-phase, windowing, etc.
Correlation

Infinite Impulse Response (IIR) digital filtering

How IIR filters work
IIR Filter design techniques - bilinear transform & frequency warping etc.
Wordlength, precision and stability issues

Introduction to Fourier transforms

Continuous and discrete Fourier transforms
The fast Fourier transform (FFT)
How the FFT works

Day 2

Fast Fourier transforms and Windowing

Short time Fourier transform limitations
Windowing functions
Using the FFT for convolution
Fourier transform applications and implementations

Sampled Data Systems And Anlog I/O

Quantization and sampling
ADCs - Successive approximation, Sigma-Delta, Flash, companders and codecs
DACs - Multiplying, Sigma-Delta etc., sin(x)/x effects

Practical applications of DSP part 1

A practical look at some of the algorithms that we have already studied, including :

The Fast Fourier Transform
Zoom-FFT
Frequency domain filtering

Matlab hands-on lab

Using the Matlab software package to simulate signals and systems in both the time and frequency domains. This module uses pre-written scripts and does not require the attendee to know how to program Matlab. We like to run these sessions with two attendees per workstation so that they can discuss their observations between themselves.

Day 3

Practical applications of DSP part 2 - ***includes real-time classroom demonstrations***

Frequency domain interpolation
Transducer response removal
System response analysis

Introduction to DSP programming and floating point implementation

DSP Architectures
Simulation, programming and debugging techniques

This is a generic module and does not focus on any specific DSP or manufacturer although we are more than happy to tailor this to your specific target device or architecture. We have experience in programming DSPs from Texas Instruments, Analog Devices, Freescale, StarCore Alliance and many more. We are also experts in using general purpose microprocessors in DSP applications.

Digital Signal Processor programming and system issues

This module can be configured to cover your choice of deployment processor
FPGA /ASIC implementation
General Purpose DSPs
Microcontroller
Includes fixed point processing techniques

Optional Modules Include

We are happy to tailor our DSP courses to meet your specific requirements. Here is a list of some of the optional modules that we have developed in the past. You are welcome to choose from any of these or request your own custom modules. We are also able to tailor a course to fit in with your chosen DSP device or platform.

Digital Communications - modulation and demodulation techniques

Digital communications techniques
Using DSPs to implement digital modulators and demodulators
Carrier and symbol rate detection, including Phase Locked Loop (PLL) and Costas loop techniques
FSK, nPSK, QAM
Narrowband and wideband (Spread spectrum) techniques.

DSP for Voice Over IP

Speech compression techniques, including a look at the ITU G-Series, 3GPP and royalty free codecs
Decompression
Packet loss concealment
Echo cancellation
Packetization / depacketization - RTP/UDP etc.

Programming FPGAs And ASICs For DSP

Device architectures
Algorithm implementation techniques
Programming techniques
Applications of FPGAs and ASICs

Machine Health Monitoring / Noise Vibration And Harshness

Filtering and signal conditioning
Magnitude, RMS and peak monitoring
A, B and C spectrum weighting
Octave analysis
Spectrum analysis
Cepstrum analysis
Order analysis

Course Handouts

All of the course attendees are provided with the following :

Printed course handouts
Access to a private web site that includes all presentation and support material.
A non expiring license for Digital Filter Plus, our digital filter design program. This allows attendees to design and simulate filters associated with the course.

Existing customers of the Numerix DSP courses include :

The University of Oxford Summer Engineering Program - UK
Loughborough University Department of Electrical and Electronic Engineering - UK
CMP Embedded Systems Conferences - CA, IL & MA, USA
Fermi National Accelerator Laboratory - IL, USA
Rolls Royce plc, Aerospace Division, UK
US Government, USA

Course And Presenter Feedback

"This class finally clears up years of confusion from my undergraduate course work"
"Excellent presenter, a good way of presenting information"
"Class was excellent! Hard to improve"
"Great class! this was by far the best class of the conference"
"Great job! it was a long day but we got our money's worth with this lecture"
"This is a great class from a very bright and accomplished professor! please bring it back next year"
"Excellent examples"
"The course was great, well delivered with the right pace and number of breaks"
"This was a fantastic course, delivered really well and to an appreciative audience"
"An excellent course, packed with useful information, and very well presented"
"Many thanks for a great course and an absorbing three days"

Although we are based in the UK, we are more than happy to travel and we guarantee value for money, whereever you live and work.

Please contact us to discuss tailoring of these courses to your specific requirements and also for a formal quotation.

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