

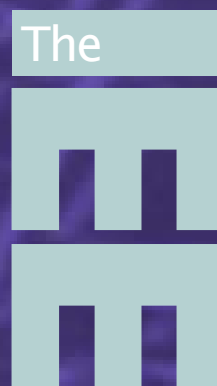
3RD GENERATION MOBILE FOR DSP, ASIC & RF ENGINEERS

4 Day Short Course, April 4th-7th 2005

**Buchanan Arms Hotel, Drymen,
Loch Lomondside, Scotland, UK**

(25 minutes from Glasgow Airport)

Co-Sponsored by



Institution of Electrical Engineers
(Signal Processing Professional Network)

Powered by

DSPedia
www.dspedia.com

Managed by



Over the next few years the 3rd generation of mobile wireless communications will bring significantly increased mobile data rates, and therefore allow the implementation and adoption of many new and enhanced multimedia services. The advent of IMT2000 and emergence in the last year of 3GPP (3rd Generation Partnership Project) standards paves the way for essentially a global standard within 2-3 years. Users can expect fixed point data rates of up to 2Mbits/sec and roaming data rates of 384 kbits/sec. 3G is fundamentally based on spread spectrum and code division multiple access systems. Hence in this course we will ensure a clear presentation of these techniques and a roadmap of how and why they are used for 3G.

Course Aim

To educate engineers in the digital signal processing (DSP) and communication strategies for 3rd generation (3G) mobile communications and provide hands-on simulation experience of advanced 3G systems.

Who Should Attend? This course is aimed at providing an intensive training for 3rd generation (3G) mobile communication DSP techniques, algorithms and architectures. The audience for the course is likely to be professional digital, analogue RF or ASIC engineers (although not necessarily with a DSP background) and currently working within the communications industry. By ensuring that participants are first familiarised with the mathematical tools and theory of DSP, the course includes practical laboratory sessions to allow all participants to achieve an intuitive and practical understanding of the various 3G techniques and systems.

Course Presentation

DSP communications is often seen as an esoteric and very mathematical subject. In this course, the necessary mathematics is presented on a "need to know basis" and in an intuitive style using both simulations and DSP/communication simulations. The course format is:

- 50% Lectures;
- 10% Tutorial Discussion;
- 40% DSP software hands-on simulation.

Achievable Skills

On successful completion of the course, attendees will be able to:

- Analyse DSP systems using time domain mathematics and frequency domain/ z-domain mathematics;
- Know the architecture of a DSP comms system;
- Design and implement FIR, IIR, and adaptive digital filters for communications applications;
- Understand the key theory of channel coding and decoding via block and convolutional techniques;
- Understand rate matching and interleaving and 3G radio framing;
- Understand spread spectrum techniques and the implementation of DS-SS and DS-SS-SS strategies for 3G;
- Acquire the know-how to simulate complete DSP

communication systems using DSP comms software;

- Know the function and basic parameters of the 3GPP uplink and downlink air interface;
- Know the functionality of advanced DSP components such as the rake receiver, and complex equalisers;
- Understand the relationship between the various worldwide organisations focussing on IMT2000.

Course Materials

All participants receive more than 1200 pages of notes in seven professionally A5 bound volumes:

1. A DSP A-Z Reference;
2. Introductory DSP Class Notes;
3. Advanced DSP Class Notes;
4. DSP Communications;
5. 3G Mobile DSP
6. DSP SystemView Simulation Workbook;
7. DSP Hardware Workbook (for offline study).

The notes provided form a superset of the materials presented on the course, and will allow further in depth study of DSP after the course. A number of DSP topics not included in the course presentation can be found in the notes.

Multimedia CDROM

<http://www.dspedia.com>: Attendees will receive a copy of the **DSPedia** multimedia CDROM (v3.0) including:

1. Hypertext of all printed notes;
2. Integrated multimedia presentations;
3. More than 100 DSP audio demonstrations;
4. More than 200 SystemView DSP demos;
5. SystemView DSP Evaluation License;
6. Links to DSP WWW sites;
7. Mnemonic video DSP ideas/tips/animations.

The **DSPedia** is available at £625 to non-attendees.

3G Simulation

SystemView by Elanix[®] DSP design software will be used on the course. This software provides a comprehensive and state-of-the-art DSP communications platform. The Entegra **3GPP CDMA** library will also be used on the course. This library will provide hands-on and standard compliant simulation exercises of both simple and advanced 3G systems such as a complete rake receiver. As post-course support a SystemView evaluation license is available to participants to continue using after the course for 14 days.

Pre-requisites

This course has been carefully designed to present the complex mathematical DSP theory often associated with DSP in an intuitive and straightforward and pragmatic style to an audience of engineers who will likely have previous exposure to DSP. The following prior experience is useful but not essential (i) Programming principles; (ii) Electrical engineering principles; (iii) Bachelor level mathematics; (iv) Basic digital signals background.

Syllabus

Day 1

Mobile Communication Generations...

- 1st generation analog mobile
- 2nd generation mobile - GSM
- 3rd generation UMTS, IMT2000
- 3G partnership project (3GPP)

DSP Fundamentals Review

- ADCs and DACs / Signal Conditioning
- Anti-alias and reconstructions Filters
- z-domain representation and transforms
- The DFT, FFT and Power Spectra
- FIR and IIR Digital Filters
- All-pass, CIC, MA, ARMA, comb filters etc..
- Poles and zeroes and the Z-domain
- The Generic DSP Processor Architecture

Advanced DSP Algorithms Review

- Decimation and interpolation
- Polyphase, QMF and multirate filters
- Undersampling and bandpass sampling
- Sigma delta and bandpass sigma delta
- Least squares (LS) and Least mean squares (LMS)
- Channel equalisation / Inverse system identification
- Echo Control for feedback suppression

Day 2

DSP Baseband Communications

- Information theory
- Noise in communications systems
- Pulse shaping / Matched Filtering
- Intersymbol interference
- Root raised cosine (RRC) filtering
- Equalisation LMS Decision Feedback Equaliser (DFE)
- Bit rates and "chipping" rates

Modulation and Mixing Strategies

- AM/FM/PM modulation
- ASK/PSK/FSK signalling
- Quadrature amplitude modulation (QAM)
- Complex notation and representation
- Quaternary phase shift keying (QPSK), 8-PSK
- RF and IF modulation and demodulation

Multuser Access (MA) and Detection Techniques

- Time/Frequency/Code Division MA (TDMA/FDMA/CDMA)
- Spread spectrum techniques
- Coding gain
- Direct Sequence Code Division MA (DS-SS/CDMA)
- PRBS sequence generation - Gold, Kasami, Walsh
- OVSAF - Orthogonal variable spreading function

Day 3

Wideband Receiver Techniques

- The CDMA near far problem
- Power control
- Matched filters
- The rake receiver
- Adaptive multiuser receiver
- Adaptive channel equalisers (DFE)
- Interference suppression techniques
- Adaptive beamforming
- Fading channels

Channel and Source Coding

- Block coding/ Reed-Solomon coding
- Convolutional coding
- Turbo coding
- Trellis coding
- Viterbi decoding; Hard and soft decoding
- Rate matching - puncturing/repetition bits
- Interleaving and deinterleaving
- Speech coding - Linear predictive techniques
- Adaptive multirate speech coding

Day 4

Software Radio (SR) DSP

- Undersampling techniques
- Direct digital downconversion
- Bandpass sigma delta
- Zero IF techniques
- Case Studies - Harris DDC chipset
- FPGA enabled SR
- "Bluetooth" example

Universal Mobile Telephone System (UMTS)

- UTRA - UMTS Terrestrial Radio Access
- IMT2000
- FDD - Frequency division duplex
- TDD - Time division duplex
- 3GPP - 3G partnership project
- ARIB/ ETSI/ TTA/ TTC ITU & commercial companies

3GPP Frequency Division Duplex (FDD) Study

- Transport, data, control and pilot channels
- Uplink and downlink architectures
- 3GPP - 3G partnership project
- 3GPP - Standard study
- Bits, slots and radio frames
- Rate matching
- Air interface
- Channel leakage and spurs

Bit True Simulation and RF Requirements

- Noise budget analysis
- RF amplifier headroom requirements
- AWGN vs true WCDMA modelling

More Details.....

For more details visit the Entegra web site at:
<http://www.entegra.co.uk/course.htm>

Entegra have successfully presented **DSPedia** courses to engineers from virtually every major DSP and communications organisations in the UK and the USA, from small start-ups, universities and Government agencies and offices. Versions of this course are presented twice a year in USA at University of California, Los Angeles to more than 100 attendees. Please contact Entegra for information on previous course successes and course testimonies and recommendations.

For your on-site course requirements and custom syllabus development please contact Entegra Ltd.

Coordinator

The course will be presented and coordinated by Prof Bob Stewart with input from other experienced engineers from Entegra. Over the last few years Bob has presented versions of this industry course both in Europe and in the USA, primarily at the University of California (UCLA). Attendees come from a wide audience of engineers and technologists working in general DSP, communications, mobile, and multimedia industries. The courses have consistently achieved an excellent rating by attendees (9.5/10 in the USA) and Bob now has a deserved international reputation as one of the premier DSP educators for industry.



Strathclyde, UK and since 1997 has been a part-time Visiting Professor at the University of California, Los Angeles. In session 1998/99 Bob was working with Entegra Ltd on a Royal Academy of Engineering Industrial Secondment scheme. Prior to joining the University of Strathclyde, he was a visiting Professor in Department of Electrical Engineering at the University of Minnesota in 1990, and a visiting scholar at the University of Southern California in 1986/7. He has acted as a consultant and provided on-site training in DSP to a number of companies.

Bob's research is in the areas of DSP enabled communications, 3G mobile, adaptive signal processing, and DSP algorithms for FPGAs. This work is variously funded by industry and Government agencies. Over the last 15 years he has published more than 150 technical papers, one textbook and three CDROMs. Bob is a Chartered Engineer, and a member of the IEEE, the IEE and a member of IEE and Eurasip technical committees.

<http://www.eee.strath.ac.uk/r.w.stewart>

Biography: Bob is currently a Professor in the Department of Electronic and Electrical Engineering at the University of

Registration

The full cost per person is £1550 (including lunch and refreshments). 20% discount is offered for 2 or more attendees from the same company site and IEE Members are further discounted by 20% each for 2004/2005 members. The course is presented at the **Buchanan**

Arms Hotel (<http://www.buchananarms.co.uk>, Tel: 01360 660588) just outside Glasgow at the start of the Scottish Highlands. The hotel has extensive bars and dining service, and leisure centre with pool, gym, and squash courts.) **Glasgow Airport is 25 minutes** drive from the Hotel, and connected to most major UK and European airports by BA, British Midland, EasyJet, & KLM. For travel assistance contact Entegra Ltd, or view <http://www.entegra.co.uk/dspcourses.htm>.

Attendee

Name _____ Company _____

Address _____

_____ City _____ Postcode _____

Telephone _____ Fax _____ E-mail _____

- | | | |
|---|--|---------|
| <input type="checkbox"/> Standard Rate | £1550 each (subtract 20% discount for 2 from same company) | £ _____ |
| <input type="checkbox"/> Student Rate | £845 each (Please enclose evidence of full time study) | £ _____ |
| <input type="checkbox"/> IEE Member Rate | £1240 each IEE Member No. _____ | £ _____ |
| <input type="checkbox"/> IEE Student Rate | £690 each IEE Student No. _____ | £ _____ |
| | + VAT @ 17.5% | £ _____ |
| | TOTAL | £ _____ |

Payment

- I enclose a cheque (including VAT) made payable to Entegra Ltd for £ _____
- Please invoice my company for: £ _____

Hotel

Please register me for *Dinner, Bed and Breakfast* accommodation at the course rate of £55 per night on:

Sun 3rd April Mon 4th April Tues 5th April Wed 6th April

I will make my own arrangements (Accommodation costs paid directly to hotel)

Send to...

Mrs Kathy Ollington
Entegra Ltd
2 Waltham Road
Maidenhead,
Berks. SL6 3NH

Tel: 01628 829061
Fax: 01628 824790
Email: info@entegra.co.uk
<http://www.entegra.co.uk/dspcourses.htm>



Entegra Ltd reserves the right to cancel or modify the course at short notice and will not accept liability for costs incurred by participants or their organisations for cancelled travel arrangements and/or accommodation reservations.