



## Modern Digital Receiver Techniques: From Theory to Practice

18–20 February 2008

Presenters: Prof. Bill Cowley and Dr Mark Reed

Mawson Lakes SA

### Teaching Arrangements:

This 3 day short course will be held at the UniSA Mawson Lakes campus. It will include MATLAB-based tutorials where attendees will obtain hands-on experience in selected course topics. Specific software will be provided so that students can investigate the performance of receiver designs under various channel and noise conditions and, where possible, add small enhancements. These sessions will backup the lecture presentations and allow a deeper understanding of the course material. **This course can be credited towards an award being received via the CEI program.**

The course will be conducted from 9.00am to 5.00pm. Morning tea will be available at approximately 10.00am to 10.30am, lunch from 12.30pm to 1.30pm and afternoon tea at approximately 3.00pm to 3.30pm.

### Registration Fee:

AU\$1980 (including GST)

**Early bird rates:** AU\$1683 (incl. GST)  
**register before 9<sup>th</sup> Nov 2007**

Group and PhD student discounts available. Please enquire.

For details of further courses please see our web site:

[www.nicta.com.au/short\\_courses](http://www.nicta.com.au/short_courses)

or contact the NICTA Industry Education Manager.

### About *Modern Digital Receiver Techniques: From Theory to Practice*

This **3-day** short course will focus on modern receiver design, including signal processing architectures, synchronisation algorithms and the inclusion of iterative (i.e. turbo) decoding methods in receiver processing. We will assume basic knowledge of digital communication techniques and will describe algorithms used for modern modulation, coding and multiple access methods. The course describes the underlying approaches used to realise terrestrial and satellite communications standard such as 3G (UMTS), WiMAX, DVB-S2 etc. It is presented by researchers who have extensive experience in this area, both with a background in theory and practical methods of receiver implementation. During the course attendees will obtain "hands-on" experience in selected areas through MATLAB-based tutorials.

**Assumed knowledge:** Basic digital signal processing and digital communication systems, MATLAB programming.

### Brief Course Outline

**Discrete-time Architectures for Digital Modems:** from classical QAM architectures to practical discrete-time architectures; sampling and synthesis methods; sample rate conversion; filtering design and implementation; introduction to modem simulation and testing.

**Synchronisation Algorithms for Digital Modems:** comparison of feedforward and feedback schemes; introduction to synchronisation algorithms for frequency, phase and timing; burst demodulation techniques; bounds and simple performance analysis.

**Introduction to Integrated Demodulation and Decoding:** Overview of the turbo principal; introduction to serially concatenated convolutional codes; using the demapper as an inner decoder; turbo phase estimation.

**Introduction to CDMA Receivers:** Rationale for spreading; CDMA architectures and synchronisation; extending CDMA systems to multi-user detection; overview of current CDMA standards.

**Introduction to OFDM Systems:** rationale for OFDM and introduction to current OFDM standards; use of the FFT in OFDM systems; synchronisation and channel estimation in OFDM; coded OFDM systems.

**New Approaches in Digital Receivers:** integrating channel estimation in a turbo receiver; complexity reduction methods in MAP detectors; introduction to multiple antenna methods (MIMO, AAS).

### About the Presenters

**Bill Cowley** worked initially for the Post Master General's Department, then joined DSTO in 1979. In 1985 he completed his Ph.D. with Adelaide University and then he moved to the Digital Communications Group at the South Australian Institute of Technology. During the last 20 years Bill Cowley has worked mainly in modem signal processing. This has included a wide range of bit rates, access methods and application areas. He is currently Professor of Communications Signal Processing and Leader of the Applied Signal Processing Research Group in ITR at the University of South Australia.

**Mark Reed** pioneered the area of iterative receiver design with the publication of his PhD thesis titled "Iterative Receiver Techniques for Coded Multiple Access Communication Systems" in 1998. He has worked in industry and research positions for the last 15 years with positions in the U.S.A., Switzerland, and Australia. His experience includes working in a team that designed and developed a world first Satellite-UMTS Modem and research into advanced signal processing schemes, including MUD, for link improvement in UMTS. Since April 2003 Dr Reed is employed as a Senior Researcher at NICTA and is also an Adjunct Fellow at ANU where he is involved in research, education, commercialisation, and linkages in the wireless signal processing program. He has over 45 international journal and conference papers and has been listed as inventor on six patent applications.

## About NICTA and Short Course Program

National ICT Australia (NICTA) is Australia's ICT Centre of Excellence and was established to drive innovation through high quality research, research training and technology transfer. As a world-class research institute NICTA uniquely combines excellence in research, education, commercialisation and collaboration. We are working to ensure that Australia is well placed to benefit from the significant opportunities that ICT research delivers.

NICTA is funded by the Australian Government as represented by the Department of Communications, Information Technology and the Arts and the Australian Research Council through *Backing Australia's Ability* and the ICT Centre of Excellence program. NICTA members are the Australian Capital Territory Government, the New South Wales Government, the University of New South Wales and the Australian National University.

NICTA short courses offer scientists, engineers and managers technical training with a leading edge in areas such as telecommunications, transport, security, defence, logistics, e-government, mining, finance and biotechnology.

There will be ample opportunities for discussion and questions and answers. Morning and afternoon tea/coffee and a light lunch will be provided. Extensive workshop materials will be made available to participants.

### How to register

Please complete the registration form below and

- Fax it to +61-8-8302-3115 or
- Scan and email it to [industryeducation@nicta.com.au](mailto:industryeducation@nicta.com.au).

**Send the form as soon as possible to secure your place.**

For further information please contact  
Anne-Marie Eliseo  
Industry Education Manager  
Telephone: +61-8-8302-3928  
Email: [anne-marie.eliseo@nicta.com.au](mailto:anne-marie.eliseo@nicta.com.au)

## Registration Form and Tax Invoice\* ABN 62 102 206 173

\*Upon completion of this form, including the relevant payment, this form will become a Tax Invoice.

**Please register me for Modern Digital Receiver Techniques: From Theory to Practice on 18-20 February 2008.**

PLEASE PRINT

Date: \_\_\_\_\_

Title: \_\_\_\_\_ First Name: \_\_\_\_\_ Surname: \_\_\_\_\_

Position: \_\_\_\_\_ Organisation/Division: \_\_\_\_\_

Postal Address: \_\_\_\_\_

Telephone No: \_\_\_\_\_ Facsimile No: \_\_\_\_\_ Email: \_\_\_\_\_

Dietary preference: \_\_\_\_\_

Course Fees:  Early bird fees: AU\$1683 (incl. GST)  
(Please register by **Nov 9<sup>th</sup>**.)

Full fees: AU\$1980 (incl. GST)  
(Please register by **Feb 8<sup>th</sup>**.)

### Method of Payment (please tick below):

Cheque (payable to National ICT Australia Ltd)

Please forward the cheque and a copy of THIS registration form to:

Anne-Marie Eliseo, Industry Education Manager, NICTA, SPRI Bld, Mawson Lakes Boulevard, Mawson Lakes SA 5095, Australia.

Credit Card: Credit Card No.: \_\_\_\_\_ Expiry Date: \_\_\_\_\_

Visa  Master Card Name on card: \_\_\_\_\_

Amount: AU\$ \_\_\_\_\_ Signature: \_\_\_\_\_  Tick if receipt required

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**Please advise by email to Annette Van Bramer**  
[annette.vanbramer@nicta.com.au](mailto:annette.vanbramer@nicta.com.au)  
**when payment is made**

BANK	Commonwealth Bank of Australia
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ACCOUNT NUMBER	1032 4576
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