Multiuser Communications

20 August 2007

Presenter: Prof Alex Grant

Rialto Hotel on Collins
495 Collins St, Melbourne VIC

Course Topics:

- **Introduction**
- **Linear Multiple Access Channels**
- **Multiuser Information Theory**
- **Multiuser Detection**
- **Implementation of Multiuser Detectors**
- **Multiuser Decoding**

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$770 (including GST)

Early bird rates: AU$616 (incl. GST)
register before 20th Jun 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
or contact the NICTA Industry Education Manager.

About *Multiuser Communications*

Many communications systems, such as cellular mobile radio and wireless local area networks, are subject to multiple-access interference, caused by a multitude of users sharing a common transmission medium. The performance of receiver systems in such cases can be greatly improved by the application of joint detection and decoding methods. Multiuser detection and decoding not only improves system reliability and capacity, it also simplifies the problem of resource allocation.

This **1-day** short course provides the tools for the design and analysis of joint detection and joint decoding methods. These methods are developed within a unified framework of linear multiple-access channels, which includes code-division multiple-access, multiple antenna channels and orthogonal frequency division multiple access.

Emphasis is placed on practical implementation aspects and modern iterative processing techniques for systems both with, and without integrated error control coding.

Prerequisites:

Essential: Digital communications, Estimation and Detection. **Preferable:** Linear algebra, Information theory, Modern error control coding (e.g. turbo codes)

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.

In July 2005 NICTA boosted its education by taking on the short course business of the Cooperative Research Centre for Sensor Signal and Information Processing (CSSIP) and Wedgetail Training, Research and Development Centre (Wedgetail TRDC).

The education model established by CSSIP and Wedgetail TRDC provided scope for delivering in-house programs tailored to specific needs of organizations. NICTA, with its extensive network of world-class researchers, is now offering a greater variety of short courses in an increasing number of locations in Australia and sometimes internationally. NICTA short courses connect research with industry by providing practical information from experts on how to solve key problems in industry and government. The Program offers 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.

Course Topics

Introduction: Multiple Access Channels; Transmitter and Receiver Cooperation;
Linear Multiple Access Channels: Continuous Time Model; Discrete Time Model; Matrix Representation; Principles of Detection; Access Strategies; Modulation Sequence Design;
Multiuser Information Theory: Probabilistic Channel Model; Capacity Region; Binary Input Channels; Gaussian Channels (including CDMA); Multiple Access Codes; Superposition and Layering; Feedback; Asynchronous Channels;
Multiuser Detection: Optimal Detection; Correlation Detection; Decorrelation; Linear Minimum Mean Squared Error Detection; Whitening Filters;
Implementation of Multiuser Detectors: Iterative Filter Implementations; Parallel Interference Cancellation; Serial Cancellation; Gradient Based Methods; Tree Search Methods;
Multiuser Decoding: Iterative Decoding; Interference Cancellation; LMMSE Filtering; Variance Transfer Analysis; Unequal Rates and Powers;
Prerequisites: Essential: Digital communications, Estimation and Detection. **Preferable:** Linear algebra, Information theory, Modern error control coding (e.g. turbo codes)

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.

Instructor: Professor Alex Grant

Alex Grant received the B.E. and Ph.D. degrees from the University of South Australia in 1993 and 1996 respectively. Since March 1998 he has been with the Institute for Telecommunication Research, University of South Australia.

He served as Technical Program Chair for the 2001 IEEE Information Theory Workshop, and as General Co-Chair for the 2005 IEEE International Symposium on Information Theory. Prof. Grant has published a book on multi-user communications, various technical papers and patents, and is supported by several Australian Research Council grants and industry-sponsored projects. He is a National ICT Australia Fellow, and a Principal Fellow at the University of Melbourne. Prof. Grant is co-founder of Cohda Wireless, an Adelaide-based mobile broadband company. He was awarded a 2004 Tall Poppy award from the Australian Institute of Political Science.

Please complete the registration form and send it together with your fee, if appropriate, to

Anne-Marie Eliseo,
Industry Education Manager,
NICTA, SPRI Building,
Mawson Lakes Boulevard,
Mawson Lakes, South Australia, 5095.
Telephone: (08) 8302 3928
Facsimile: (08) 8302 3115
Email: 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 Multiuser Communications on 20 August 2007.

PLEASE PRINT Date:

Title: First Name: Surname:

Position: Organisation/Division:

Postal Address:

Telephone No: Facsimile No: Email:

Dietary preference:

Course Fees: ☐ Early bird rate: AU$616 (incl. GST) (Please register before **Jun 20th, 2007**.) ☐ Full fee: AU$770 (incl. GST)

Method of Payment (please tick)

☐ Cheque (payable to National ICT Australia Ltd)
Please forward cheque and a copy of THIS Registration Form to the NICTA Industry Education Manager.

☐ Credit Card: Credit Card No.: Expiry Date:

☐ Visa ☐ Master Card Name on card:

Amount: AU$ Signature: ☐ Tick if receipt required

☐ Electronic Funds Transfer
Please advise by email to Annette Van Bramer annette.vanbramer@nicta.com.au when payment is made

BANK	Commonwealth Bank of Australia
ACCOUNT NAME	National ICT Australia Limited
BSB	062 900
ACCOUNT NUMBER	1032 4576
REFERENCE NUMBER	200807

Privacy Clause: The above information is being collected by NICTA and will be added to our contact database and will be used primarily to provide you with further information about NICTA events and services. All information is collected, used or disclosed subject to NICTA's Privacy Policy which can be accessed at http://nicta.com.au/privacystatement.cfm. Please tick the box below if you do NOT wish to receive any further mailings from NICTA.

☐ I do not wish to receive any further mailings from NICTA

You can use the following options to access or remove your personal information from NICTA's databases, make a complaint about a breach of privacy or if you have a query relating to NICTA's privacy practices and policies:

- Send an email to comments@nicta.com.au or
- Phone NICTA's Industry Education Manager on +61 8 8302 3928.