6 Degrees of Freedom Modelling and Simulation of Aerospace Vehicles

19-20 October 2009

Presenter: Dr Peter Zipfel

Technology Park Conference Centre
Mawson Lakes SA

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.

Each attendee will receive a copy of instructor's textbook *Modeling and Simulation of Aerospace Vehicle Dynamics*, AIAA 2007 and all simulation and plotting software on CD-ROM.

Registration Fee: AU$1485 (incl. GST)

Early bird rates: AU$1320 (incl. GST)
register before 19 June 2009

Group and PhD student discounts available. Please enquire.

How to Register

To register fill out the registration form (overleaf) and

- fax it to +61-8-8343-8711; or
- scan and email it to industryeducation@nicta.com.au

Cancellation Policy

At least **4 weeks** notice is required for cancellation of a place in a short course for full reimbursement. If cancellation is later than 4 weeks then the place can either be given to another person or the registrant can be provided with a credit towards other NICTA training.

For details of further courses please see our web site: www.nicta.com.au/short_courses or contact the NICTA Industry Education Manager.

About this Course

As modeling and simulation (M&S) is penetrating the aerospace sciences at all levels, this **two-day** course will introduce you to the difficult subject of modeling aerospace vehicles in six degrees of freedom (6 DoF). Starting with the modern approach of tensors, the equations of motion are derived and, after introducing coordinate systems, they are expressed in matrices for compact computer programming. Aircraft and missile prototypes will exemplify 6 DoF aerodynamic modeling, rocket and turbojet propulsion, actuating systems, autopilots, guidance, and seekers. These subsystems will be integrated step by step into full-up simulations. For demonstrations, typical fly-out trajectories will be run and projected on the screen. The provided source code and plotting programs lets you duplicate the trajectories on your PC (requires FORTRAN or C++ compiler). With the supplied textbook "Modeling and Simulation of Aerospace Vehicle Dynamics" and the prototype simulations you can build your own 6 DoF aerospace simulations.

Target Audience: This course is valuable for engineers tasked to employ, modify or develop detailed aerospace vehicle simulations and to conduct performance evaluations. Some familiarity with vehicle dynamics and control is assumed, but no prior knowledge of simulations is required.

Brief Course Outline

Concepts in Modeling with Tensors: Definitions; the M&S pyramid.
Matrices, Vectors, and Tensors: Invariant modeling with tensors; Definition of frames and coordinate systems.
Coordinate Systems: Heliocentric, inertial, geographic coordinate systems; Body, wind, flight path coordinate systems.
Kinematics of Flight Mechanics: Rotational time derivative; Euler transformation.
Equations of Motion of Aircraft and Missiles: Newton's translational equations; Euler's attitude equations.
Aerodynamics of Aircraft and Missiles: Aircraft aerodynamics in body coordinates; Missile aerodynamics in aeroballistics' coordinates.
Propulsion: Rocket, turbojet and combined cycle propulsion.
Autopilots for Aircraft and Missiles: Roll and heading autopilots; Attitude autopilots; Acceleration autopilots.
Seekers for Missiles: Radar and IR sensors.
Guidance and Navigation: Line guidance, proportional navigation; Optimal guidance laws.
Full-up Aircraft Simulation in FORTRAN and C++.
Full-up Missile Simulation in FORTRAN and C++.

About the Presenter

Dr Peter Zipfel has been an Adjunct Associated Professor at the University of Florida since 1978. He has taught courses in flight dynamics of missiles and aircraft, guidance and control, modeling and simulation with FORTRAN and C++. His 45 years of M&S experience was acquired at the German Helicopter Institute, the U.S. Army and Air Force. He is an AIAA Associate Fellow, serves on the AIAA Publication Committee and the AIAA Professional Education Committee, and is a distinguished international lecturer. His most recent publications are all related to aerospace modeling and simulation: "*Building Aerospace Simulations in C++*", 2008; "*Fundamentals of 6 DoF Aerospace Vehicle Simulation and Analysis in FORTRAN and C++*", 2004; and "*Advanced 6 DoF Aerospace Vehicle Simulation and Analysis in C++*", 2006, all published by AIAA.

Registration Form →

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 +61–8–8343-8711 or
- Scan and email it to 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: +61–8–8343-8710
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 Six Degrees of Freedom Modelling and Simulation of Aerospace Vehicles on 19-20 October 2009.

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$1320 (incl. GST and a book) (Please register by **Jun 19**.) ☐ Full fees: AU$1485 (incl. GST and a book) (Please register by **Oct 5**.)

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, Innovation House, First Ave, Mawson Lakes SA 5095, Australia.

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

☐ Visa ☐ Master Card Name on card:

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

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- Send an email to comments@nicta.com.au or
- Phone NICTA's Industry Education Manager on +61 8 8343 8710.