

## CURRICULUM VITAE (Last update: 25 October 2012)

**Name:** Eleuterio F. TORO.

**Born:** 16th July 1946 in Chile.

**Nationalities:** Chilean and British.

**Current position:** Professor of Numerical Analysis (*Professore Chiara Fama*),  
Department of Mathematics, University of Trento, Italy. Since January 2002.

### EDUCATION

1962-1967 Victoria Teacher Training College, Chile. Graduated as school teacher (Biology and music).

1969-1973 Catholic University of Temuco, Chile. Pedagogy in Mathematics.  
Studies interrupted in 5<sup>th</sup> and final year.

1974-1974 Catholic University of Santiago, Chile. Mathematics. Studies interrupted.

1975-1977 University of Warwick, UK. BSc Honours in Pure Mathematics.

1977-1978 University of Dundee, UK. MSc in Applicable Mathematics (Functional analysis and differential equations). MSc dissertation: "On the support of solutions to a class of parabolic equations".

1978-1982 University of Teesside, UK. PhD in Computational Mathematics. Research assistant.  
PhD thesis: "Finite Element Computation of Free Surface Flows".

### HONOURS AND DISTINCTIONS

2000 Honorary title OBE (Officer of the Order of the British Empire), conferred by  
Queen Elizabeth II of England, Buckingham Palace, London, UK.

2001 Honorary Citizen of the City of Carahue, Chile.

2003 Life Fellow, Claire Hall, University of Cambridge, UK.

2005 Fellow of the Indian Society for Shock Wave Research, Bangalore, India.

2008 Doctor Honoris Causa, Universidad de Santiago de Chile.

2010 William Penney Fellow, Physics Department, University of Cambridge, UK.

2012 Doctor Honoris Causa, Universidad de la Frontera. Chile.

### PREVIOUS ACADEMIC APPOINTMENTS

1994-2001 Professor of Applied Mathematics, Manchester Metropolitan University, UK.

1991-1994 Senior Lecturer in Computational Fluid Dynamics. Department of Aerospace Sciences,  
Cranfield University, UK.

1989-1991 Lecturer in Computational Fluid Dynamics. Department of Aerospace Sciences,  
Cranfield University, UK.

1986-1989 Senior Research Fellow (permanent position). Department of Aerospace Sciences,  
Cranfield University, UK.

1983-1986 Research Fellow. Department of Aerospace Sciences, Cranfield University, UK.

1983-1983 Research Fellow. School of Mathematics, University of Leeds, UK.

1978-1982 Research Assistant. Department of Mathematics, Teesside University, UK.

### VISITING ACADEMIC APPOINTMENTS

1992 Visiting Professor. Department of Civil and Environmental Engineering, University of Trento,  
Italy (4 months).

1992 Visiting Scientist. Fraunhofer Institut fuer Kurzzeitdynamik, Ernst Mach Institute, Freiburg,  
Germany (4 months).

1993, 1999 Visiting Professor. Shock Wave Research Centre. Tohoku University, Japan (8 months).

2003 EPSRC Senior Research Fellow. Newton Institute for Mathematical Sciences,  
University of Cambridge, UK (5 months).

2010 William Penney Fellow. Physics Department, University of Cambridge, UK.

## MAIN AREAS OF RESEARCH INTEREST

- Numerical methods for partial differential equations.
- Upwind and centred approaches for hyperbolic balance laws.
- Finite volume and discontinuous Galerkin methods.
- The ADER approach to high order of accuracy in space and time, with application to advection-diffusion-reaction equations.
- Mathematical modelling and applications in general: compressible fluid dynamics, combustion, shock waves, propulsion systems, multiphase flows, nuclear-reactor safety, free-surface gravity flows, dam-break simulation, tsunami wave propagation, industrial problems.
- Mathematical modeling and application to bio-medical problems: blood flow in humans, transport phenomena in human tissue, venous thrombosis, neurodegenerative diseases eg the vascular link to multiple sclerosis.

## FUNDING ID

- 1983-2013 Consultancies for governmental and private organizations such as British Aerospace, British Gas, British Ministry of Defense, research agencies of the governments of Switzerland, Japan, Germany Italy and USA. Estimated funding: 3,000,000 EUR.
- 1995-1997 Partner in the EU project CADAM: European Concerted Action on Dam-Break Modelling. Estimated funding 400,000 EUR.
- 2000-2003 Partner in the EU project ASTAR: Advanced Three Dimensional Two-Phase Flow Simulation Tools for Application to Reactor Safety. Funding about 2,000,000 EUR.
- 2004-2006 National coordinator (principal investigator) of the two-year research programme PRIN Funded the Italian Ministry of University and Research (MIUR). Topic: Mathematical models and numerical methods for environmental problems. Participating teams from universities of Trento, Padova and Florence. Funding: 108,000 EUR.
- 2007-2009 National coordinator (principal investigator) of a PRIN project Development and analysis of mathematical models and numerical methods for partial differential equations in industrial and environmental problems funded by the Italian Ministry of University and Research (MIUR). Granted funds: 80,200 EUR.
- 2011-2013 Principal investigator of the research project *Computer simulation of blood flow in the intra/extra cranial venous system in humans with multiple sclerosis and the CCSVI condition*, funded by Cassa di Risparmio di Trento e Rovereto Foundation. Funding: 60,000 EUR.

## PUBLICATION SUMMARY

- Author/co-author of more than 270 papers, proceedings, technical reports and books.
- Author/editor of four books and two books in preparation (contracts with publisher signed).
- Total number of citations: **6736** (Google Scholar, 25-10-2012).

## MISCELLANEOUS. For more details see my homepage <http://www.ing.unitn.it/toro/>

- Collaboration (past and present) with many institutions and researchers in many countries, including: United Kingdom, Japan, Spain, United States, China, Germany, Switzerland, Russia, France, Belgium, Italy, Chile and others.
- International advanced short courses given. More than 20 courses in many countries (e.g. United Kingdom, Spain, Italy, Japan, Germany, Czech Republic, United States).
- Supervisor of many master students, PhD students and post-doctoral fellows (England and Italy).
- Examiner of many doctorate students (England, Italy, Spain, Germany, France, Norway).
- Refereeing for many international journals (e.g. Journal of Fluid Mechanics, Journal of Computational Physics, Proc. Royal Society of London, SIAM J. Numerical Analysis, IMA J. Numerical Analysis, Computers and Fluids).
- Referee for funding agencies of many countries (e.g. United Kingdom, The Netherlands,

Norway, China, Chile, Spain and Italy).

- ERC Grant refereeing.
- Member of the scientific committee of the international conferences “International Symposium on Shock Waves” and “High-order non-linear numerical methods for evolutionary PDEs”
- Honorary member of the advisory board for Symposium on Numerical Analysis of Fluid Flow and Heat Transfer.
- Member of the scientific committee of the Chilean Workshop on Numerical Analysis of Partial Differential Equations. Concepcion, Chile.

### **10-YEAR-TRACK-RECORD**

- 2003. Co-organizer of a six-month research programme on "Non-linear Hyperbolic Waves in Phase Dynamics and Astrophysics" (jointly with K Dafermos, Brown University USA and P LeFloch, University of Paris, France) at The Newton Institute for Mathematical Sciences, University of Cambridge, UK. Note: the award of these programs is highly competitive.
- 2003. EPSRC Senior Research Fellow. Newton Institute for Mathematical Sciences, University of Cambridge, UK.
- 2005 Distinction: Fellow of the Indian Society for Shock Wave Research, Bangalore, India.
- 2008 Distinction: Doctor Honoris Causa distinction conferred by Universidad de Santiago de Chile.
- 2010 Distinction: William Penney Fellow, Physics Department, University of Cambridge, UK.
- 2005 Founder and principal organizer and of the international conference on High order nonlinear methods for evolutionary PDEs (HONOM 2005, 2007, 2009, 2011) in the University of Trento, Italy. Co-organizers: C D Munz (University of Stuttgart) and M Dumbser (University of Trento) and R Abgrall (University of Bordeaux).
- 2011 Conference in my honour. Numerical Methods for Hyperbolic Equations Theory and Applications. International Conference to honour Professor E.F. Toro in the month of his 65th birthday. Santiago de Compostela, Spain, July 2011. Attended by 130 participants from 20 countries. Chairman of organizing committee: Professor M E Vazquez-Cendón. Honorary Chairman: Professor Peter Lax.
- 2012 Doctor Honoris Causa. Distinction conferred by Universidad de la Frontera. Chile.

### **INVITED SPEAKER AT INTERNATIONAL CONFERENCES AND RESEARCH SEMINARS: MORE THAN 100 IN THE PERIOD 2001-2011. BELOW ARE SOME EXAMPLES.**

- 2005 Inaugural Lecture at the 25th International Symposium on Shock Waves ISSW25, 17th to 22<sup>nd</sup> July, 2005, Indian Institute of Science, Bangalore, India. This is a major bi-annual international conference on shock waves, started in 1957, for physicists, engineers and applied mathematicians.
- 2005 Invited speaker to the French national conference La Mécanique des Fluides Numérique. Ecole Polytechnique, Paris, France, 24th January, 2005.
- 2007 Invited speaker to International Workshop on Multiphase Flows. Institute of Applied Physics and Computational Mathematics, Beijing, China. Invitations repeated (2008-2011).
- 2007 Invited (only) foreign scientist to the National Japanese Conference on Computational Fluid Dynamics, held at the Japanese Agency for Space Exploration (JAXA), Tokyo, Japan. 12th June. Additional invited talk at the Earth Simulator Centre, Tokyo, Japan. 13th June 2007.
- 2007 Invited lecturer to the JETSET School and Workshop Numerical MHD and Instabilities, Visualization Techniques and Virtual Reality, Sauze d'Oulx, Italy, January 2007.
- 2009 Inaugural Lecture at the ASTRONOM 2009 conference on Numerical Modelling of Space Plasma Flows. Chamonix, France, July 2009.
- 2009 Invitation as consultant to the University of Mississippi, Oxford Mississippi, USA, from 4th to 21<sup>st</sup> July 2009. Duties at the National Center for Computational Hydroscience and Engineering: offer a series of lectures on numerical methods for partial differential equations for postgraduate students, seminars for academic and research staff and interact with researchers on mathematical modeling and numerical methods for geophysical problems.

- 2010 Invited speaker at the 13th International Conference on Hyperbolic Problems: theory, numerics and applications. Beijing, China, 15th to 19th June 2010.
- 2011 Invited speaker. International Scientific Seminar held at the Kavli Royal Society Centre, Newport Pagnell, United Kingdom. 11th January 2011.
- 2011 Invited speaker to the Sixth DFG-CNRS Workshop on micro-macro modelling and simulation of liquid-vapour flows. University of Stuttgart, Germany, 13th January 2011.
- 2012 Computational Experiment in AeroAcoustics 2012. September 19-22, Svetlogorsk, Russia
- 2012 Summer School and Workshop Non-Homogeneous Fluids and Flows. 27-31 August, Faculty of Mathematics and Physics, Charles University, Prague. Czech Republic.

#### **TEN SELECTED JOURNAL PUBLICATIONS AS LEADING AUTHOR IN THE LAST 10 YEARS.**

- [1] E F Toro and V A Titarev. Solution of the generalized Riemann problem for advection reaction equations. Proceedings of the Royal Society of London. Series A. 458:271-281, 2002.
- [2] E F Toro and V A Titarev. TVD fluxes for the high-order ADER schemes. Journal of Scientific Computing. 24:285-309, 2005.
- [3] E F Toro and V A Titarev. ADER schemes for scalar hyperbolic conservation laws with source terms in three space dimensions. Journal of Computational Physics. 202:196-215, 2005.
- [4] E F Toro and V A Titarev. Derivative Riemann solvers for systems of conservation laws and ADER methods. Journal of Computational Physics. 212:150-165, 2006.
- [5] E F Toro and V A Titarev. MUSTA fluxes for systems of conservation laws. Journal of Computational Physics. 216:403-429, 2006.
- [6] E F Toro and P Garcia-Navarro. Godunov-type methods for free-surface shallow flows: a review. Journal of Hydraulic Research. 45:736-751, 2007.
- [7] E F Toro, A Hidalgo and M Dumbser. FORCE schemes on unstructured meshes I: conservative hyperbolic systems. Journal of Computational Physics. 228:3368-3389, 2009.
- [8] V A Titarev and E F Toro. ADER: Arbitrary High Order Godunov Approach. Journal of Scientific Computing. 17: 609-618, 2002.
- [9] E F Toro and M E Vazquez-Cendon. Flux splitting schemes for the Euler equations. Computers and Fluids. Available online 2 October <http://dx.doi.org/10.1016/j.compfluid.2012.08.023>.
- [10] E F Toro and A Siviglia. Flow in collapsible tubes with discontinuous mechanical properties: mathematical model and exact solutions. Communications in Computational Physics. Vol. 13, Number 2, pp 361-385, Feb. 2013.

#### **BOOKS**

- [B1] E F Toro. Riemann solvers and numerical methods for fluid dynamics. Three editions. Springer Verlag, Berlin Heidelberg, 1997, 1999, 2009. (724 pages). ISBN 978-3-540-25202-3, 2009. Also available in electronic form. Citations: **2642** (Google Scholar, 25-10-2012).
- [B2] E F Toro. Shock-capturing methods for free-surface shallow flows. Wiley and Sons Ltd. Chichester, New York. (309 pages). ISBN: 0-471-98766-2. 2001. Citations: **717** (Google Scholar, 25-10-2012).
- [B3] E F Toro and J F Clarke (Editors). Numerical methods for wave propagation. Kluwer Academic Publishers 1988. (385 pages). Citations: **19** (Google Scholar, 25-10-2012).
- [B4] E F Toro (Editor). Godunov methods: theory and applications. Kluwer/Plenum Academic Publishers. (1077 pages), 2001. Citations: **133** (Google Scholar, 25-10-2012).
- [BiP1] Numerical methods for ordinary and partial differential equations. Co-authors: E Bertolazzi, G Vignoli and M Dumbser, due 2013. Book for advanced undergraduate students in science and engineering.
- [BiP2] ADER finite-volume and discontinuous-Galerkin high order schemes. Co-authors: C D Munz (Stuttgart), V A Titarev (Moscow) and M Dumbser (Trento), due 2013. Book for researchers on advanced numerical methods for partial differential equations and applications.

**SOFTWARE.** NUMERICA. A library of source codes for teaching, research and applications. 2001. ISBN 09536483 46.