REGISTRATION FORM

Full Name:_____

Title:_____

Affiliation:_____

_____

Position:_____

Address:_____

_____

State:_____ Zip Code:_____

Phone:_____

Fax:_____

Email:_____

Course Fee (please check the appropriate box):

	On or before 6/22/2009	After 6/22/2009
Ole Miss participants:	☐ $75.00	☐ $100:00
Other Participants:	☐ $150.00	☐ $175:00

The course fee includes attendance to lectures and practical tutorials, course notes and the numerical codes for exercises, coffee breaks and lunches.

Early registration is highly recommended due to limited number of spaces available!

Method of Payment:

Course fee should be paid by check (personal checks are accepted). Please write the check payable to:
National Center for Computational Hydroscience and Engineering, The University of Mississippi

This registration form and the check should be sent to:
National Center for Computational Hydroscience and Engineering
The University of Mississippi
Carrier Hall Room 102, P.O. Box 1848
University, MS 38677-1848

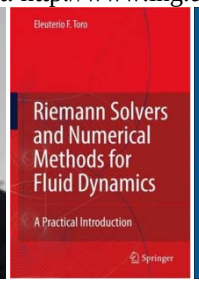
About the lecturer

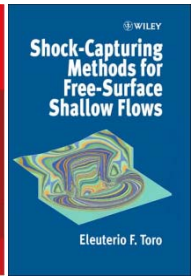
Professor Eleuterio F. Toro has made important contributions in the field of high resolution numerical methods for solving hyperbolic conservation laws, and is regarded as one of the leading applied mathematicians and authorities in this field. His research interests span over numerical methods for partial differential equations, with particular emphasis on methods for hyperbolic equations and design and application of new algorithms. Professor Toro is particularly interested in mathematical modeling and simulation of physico/chemical models of various types of processes and applications of models and methods to a wide range of real problems such as propulsion in the aerospace industry, nuclear reactor safety, accidental collapse of dams, seismic waves, generation and propagation of tsunamis, application of shock waves in medicine and industrial problems.

Professor Toro is currently a full professor of numerical analysis the University of Trento, Italy, and carries out his research and teaching activities in the Laboratory of Applied Mathematics. Previously, he held the position of Full Professor of Applied Mathematics at the Manchester Metropolitan University, United Kingdom.

Professor Toro is author of two books (see below); editor of two books of contributed research papers, and author/co-author of more than 220 scientific publications. He has taught short courses and presented invited lectures in various countries around the world. He has received numerous distinctions and honorary degrees: Officer of the Most Excellent Order of the British Empire (2000); Honorary Citizen of Carahue, Chile (2001); Fellow of the Society for Shock Wave Research (2005); Doctor Honoris Causa, Universidad de Santiago de Chile (2008).

More information at: http://www.ing.unitn.it/~toroe/





A 3-day (July 13-15, 2009) Short Course on

NUMERICAL METHODS FOR HYPERBOLIC EQUATIONS

WITH APPLICATIONS TO SHALLOW WATER FLOWS

by

Professor Eleuterio F. Toro, PhD, DHC, OBE
Laboratory of Applied Mathematics
Department of Civil and Environmental Engineering
University of Trento, Italy

Organized by the
National Center for Computational Hydroscience and Engineering
(http://www.ncche.olemiss.edu/)
The University of Mississippi

This short course is sponsored by the research project "**Simulation-Based Decision Support System for Water Infrastructural Security (DSS-WISE)**" funded by the **South East Region Research Initiative (SERRI) Program**.

SERRI (http://serri.org/) is a program managed by Oak Ridge National Laboratory (ORNL) for the US Department of Homeland Security to assist local, state and tribal leaders in developing the tools and methods required to anticipate and forestall terrorist events and to enhance disaster response.

Course description

Systems of hyperbolic partial differential equations (such as hyperbolic conservation laws) have important applications in all branches of science and engineering and their numerical solution has long been a subject of intensive research. One of the important aspects of nonlinear hyperbolic partial differential equations is the fact that even smooth initial conditions can give rise to discontinuities propagating at finite speeds. The challenge in developing numerical schemes for solving systems of hyperbolic partial differential equations resides in approximating smooth solution regions with high spatial accuracy while capturing discontinuities as sharply as possible without any oscillations. In the last couple of decades important advances have been made in this area with the introduction of finite-volume high-resolution upwind methods.

This three-day short course intends to provide participants with an overview of modern numerical methods developed for solving systems of hyperbolic partial differential equations, with special emphasis on shallow water equations, which have a wide range of applicability; such as free-surface hydraulics and environmental flows.

Who should attend?

This short-course is designed for scientists, engineers from academic institutions, industry, research laboratories, state and federal agencies, who are interested in solving practical problems involving hyperbolic partial differential equations in areas ranging from fluid dynamics, aerodynamics, hydraulics, geophysics, to elasticity, acoustics, explosions, astrophysics, electro-magnetic waves, magneto-gas dynamics, crystal growth, and traffic problems, etc.

Course organization

In the morning, basic concepts and the theory will be introduced in two 90-minute sessions separated by a coffee break. Practical tutorial sessions in the afternoon will be held in a room equipped with computers, where participants will gain hands-on experience by carrying out numerical experiments using simple numerical codes provided as part of the course material. The participants may also bring their own laptops for these practical tutorial sessions.

Course Program and Contents

Monday, July 13, 2009

08:00-08:30	Registration and Welcome Coffee
08:30-10:00	**Lecture 1**: Notions on hyperbolic equations. Eigenvalues, eigenvectors, hyperbolicity, characteristic variables. The Riemann problem for linear systems. Example: the linearized shallow water equations. Non-linear equations.
10:00-10:30	Coffee Break
10:30-12:00	**Lecture 2**: Basics on numerical methods for hyperbolic equations. Finite differences and properties of schemes. The finite volume approach. Numerical fluxes and numerical sources. Examples. Upwind methods and the Riemann problem for model problems.
12:00-13:30	Lunch Break (Johnson Commons, West)
13:30-15:00	**Practical tutorial I**: Numerical experiments using well-known numerical methods for the linear advection equation, for Burgers equation and for the linearized shallow water equations.
15:00-17:00	Optional Self Study (computer room available)

Tuesday, July 14, 2009

08:00-08:30	Welcome Coffee
08:30-10:00	**Lecture 3**: The shallow water equations. The Riemann problem. Exact solution. Godunov's first order upwind method.
10:00-10:30	Coffee Break
10:30-12:00	**Lecture 4**: The shallow water equations . Approximate Riemann solvers and numerical fluxes, HLL and HLLC. FORCE-type centred (non-upwind) fluxes.
12:00-13:30	Lunch Break (Johnson Commons, West)
13:30-15:00	**Practical tutorial II**: Numerical experiments with (i) the exact Riemann solver for the shallow water equations (ii) Godunov's method using the HLL, HLLC and the FORCE fluxes.
15:00-17:00	Optional Self Study (computer room available)

Wednesday, July 15, 2009

08:00-08:30	Welcome Coffee
08:30-10:00	**Lecture 5**: Godunov's theorem. Non-linear TVD and ENO methods for model problems. The ADER approach for non-linear systems. The MUSCL-Hancock method. Application to the shallow water equations with source terms.
10:00-10:30	Coffee Break
10:30-12:00	**Lecture 6**: Non-conservative hyperbolic systems and path-conservative schemes. Source terms and well-balanced schemes. Examples.
12:00-13:30	Lunch Break (Johnson Commons, West)
13:30-15:00	**Practical tutorial III**: Numerical experiments using second-order non-linear schemes as applied to the shallow water equations.
15:00-17:00	Optional Self Study (computer room available)

Short Course web page: http://www.ncche.olemiss.edu/toro

Certification

Participants will receive 2 CEUs or 20 PDHs. A certificate of attendance signed by the lecturer and the organizer will be provided to all participants.

Site Information

The short course will be held in Room 213 (Computer Lab) of the Carrier Hall, The University of Mississippi. The lunch will be served in the buffet-style cafeteria located in Johnson Commons, West.

Lodging

The city of Oxford has excellent accommodation facilities. Information is available upon request. Please write to *Ms. Kathy McCombs* at the following address: mccombs@ncche.olemiss.edu.

Contact Information

Questions about the short course should be directed to:

Mustafa Altinakar, Ph.D.
Associate Director & Research Professor
National Center for Computational Hydroscience and Engineering
The University of Mississippi
Carrier Hall Room 102, P.O. Box 1848
University, MS 38677-1848
Phone: + 1 662 915-3783; Fax: + 1 662 915-7796
Email: altinakar@ncche.olemiss.edu