### **Course Outline**

Lattice Boltzmann theory

Background

Fundamental LB equations

**Boundary conditions** 

Advanced collisions and entropic LB

Turbulence modelling

LB for Multi-phase flows

LB for Non-Ideal fluids

LB model for micro and nano fluid

**Basic Applications** 

Grid refinement

Advanced boundary cond's

Irregular grids

Volumetric formulation

Hands on

**Advanced Applications** 

Adaptive methods

CFD applications in automotive design

Micro and nano applications

LB and high performance computing

LBM commercial software (PowerFLOW) for

hands on applications

## Software

The material will presented on multifold support, from conventional blackboard, glossy transparency as well as pdf and ppt files. Both Windows and UNIX

## Course Language

All lectures and presentations shall be conducted in English Language. Thus, a good command of English Language is required.

# Fellowship Awards

A limited number of fellowship awards to cover 50 % of the advanced full course fee are available for graduate and undergraduate students. To be eligible for a fellowship award the applicants should send a curriculum vitae, a 1-page letter of application to explain why the fellowship is needed and two recommendation letters before November, 1.

### Class Schedule

	9.00	11.00	11.30	13.30	14.30	16.00	16.30
	11.00	11.30	13.30	14.30	16.00	16.30	18.00
Monday	×		×				
Tuesday	×		×		×		×
Wednesday	×	break	×		×	break	×
Tuesday	×		×		×		×
Friday	×	Coffee	×	Lunch	×	Coffee	×
Saturday	×	පි	×	3		<u> </u>	

### **Full Course Fee**

		Advanced (*)	Late
	Regular	1500 €	1800 €
	Students	900€	1200 €

### (Any) Three-days Fee

	Advanced (*)	Late	
Regular	900€	1100 €	
Students	550 €	700€	

(\*) before 1 December 2007. Parties of three or more from the same institution will get a 25 % discount.

Advanced registration is strongly advised. Due to the hands-on nature of this Course (demonstrations and lectures), enrolment is limited and applications will be accepted on a first come first served basis.

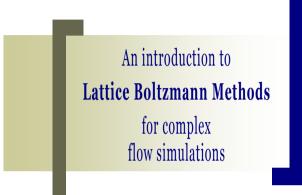
Registration fees include all course, demonstrations, didactic material, coffee breaks (2/day) and the final banquet.

To register please complete the registration form available at  $\underline{\text{http://www.h2cu.com/custom.asp?inAct=V\&inObj=7}}$ 

by e-mail: stefano.ubertini@uniroma2.it

by fax: +39 06 2331 0028

and send it to:



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Università di Roma Tor Vergata









## Introduction

The lattice Boltzmann method is a highly innovative approach to fluid dynamics, which is based on the solution of a minimal Boltzmann kinetic equation, rather than on the discretization of the Navier-Stokes equations of continuum mechanics.

This minimal Boltzmann equation, known as Lattice Boltzmann equation (LBe), was developed in the late 80's and early 90's, in response to the major drawbacks of its ancestor, the Lattice Gas Cellular Automata method.

Ever since, LBE research has known a burgeoning growth, which has led to an extremely elegant and computationally efficient approach to the most complex problems in fluid dynamics.

These range from low-Reynolds single and multiphase flows in highly heterogeneous (porous) media, all the way to fully turbulent flows in complex geometries of direct industrial relevance, such as real-life cars and airplanes.

In hindsight, the most fundamental asset of LBe rests with its mesoscopic nature, lying in between the atomistic and continuum descriptions of fluid flows. This allows LBe to combine the best of the two worlds: the geometrical flexibility of atomistic methods with the large-scale resolution of continuum methods.

# **Objectives**

The objective of this course is to present the theory and the applications of the lattice Boltzmann method for fluid dynamics. Besides the theoretical explanation of the method, the course will feature several hours of practice which will permit the students to develop their own warm-up computer code to simulate fluid dynamics with the lattice Boltzmann models.

### **Venue Information**

The one-week course will be held at: The Consiglio Nazionale delle Ricerche (CNR), Piazzale Aldo Moro 7, Rome, Italy.

# **Local Organisers**

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## **Guest Organiser**

Chen, Hudong

Exa Corporation, USA

## **Addressing Speech**

Di Giusto, Nevio

Managing Director ELASIS – FIAT GROUP

# **Opening Lecture**

Orszag, Steven A.

Yale University, Mathematics Department, USA

### Lecturers

Asinari, Pietro

Politecnico di Torino, Italy

Amati, Giorgio

CASPUR, Italy

Benzi, Roberto

Università di Roma "Tor Vergata", Italy

Biferale, Luca

Università di Roma "Tor Vergata", Italy

Boghosian, Bruce M.

Tufts University, USA

Chopard, Bastien

CUI, University of Geneva, Switzerland

Karlin, Ilya

ETH-Zentrum, Institut f. Energietechnik, Switzerland

Krafczyk, Manfred

Institute for Computational Modeling in Civil Engineering, TU Braunschweig, Germany

Famibelle, Sylviane

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Yeomans, J. M.

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