TIME TABLE

TIME	Monday May 16	Tuesday May 17	Wednesday May 18	Thursday May 19	Friday May 20
9.00 - 9.45	Registration	Vincent	Vincent	Estivalezes	Vincent
9.45 - 10.30	Vincent	Vincent	Vincent	Estivalezes	Vincent
11.00 - 11.45	Vincent	Estivalezes	Estivalezes	Balachandar	Lakehal
11.45 - 12.30	Estivalezes	Estivalezes	Estivalezes	Balachandar	Lakehal
14.00 - 14.45	Estivalezes	Vincent	Scardovelli	Balachandar	Lakehal
14.45 - 15.30	Estivalezes	Vincent	Scardovelli	Lakehal	Balachandar
16.00 - 16.45	Scardovelli	Scardovelli	Balachandar	Lakehal	Balachandar
16.45 - 17.30	Scardovelli	Scardovelli	Balachandar	Lakehal	

ADMISSION AND ACCOMMODATION

The registration fee is of 575,00 Euro + VAT taxes*, where applicable (bank charges are not included).

The registration fee includes a complimentary bag, four fixed menu buffet lunches (Friday subject to numbers), hot beverages, downloadable lecture notes and wi-fi internet access.

Applicants must apply at least one month before the beginning of the course. Application forms should be sent on-line through our web site: http://www.cism.it or by post.

A message of confirmation will be sent to accepted participants. If you need assistance for registration please contact our secretariat.

Applicants may cancel their course registration and receive a full refund by notifying CISM Secretariat in writing (by email) no later than two weeks prior to the start of the course.

If cancellation occurs less than two weeks prior to the start of the course, a Euro 50,00 handling fee will be charged. Incorrect payments are subject to Euro 50,00 handling fee.

A limited number of participants from universities and research centres who are not supported by their own institutions can be offered board and/or lodging in a reasonably priced hotel or students' dormitories, if available.

Requests should be sent to CISM Secretariat by **March 16, 2016** along with the applicant's curriculum and a letter of recommendation by the head of the department or a supervisor confirming that the institute cannot provide funding. Preference will be given to applicants from countries that sponsor CISM.

Information about travel and accommodation is available on our web site, or can be mailed upon request.

* Italian VAT is 22%.

For further information please contact:

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Piazza Garibaldi 18
33100 Udine (Italy)
tel. +39 0432 248511 (6 lines)
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SMALL SCALE MODELING AND SIMULATION OF TURBULENT MULTI-PHASE FLOWS

Advanced School coordinated by

Jean-Luc Estivalezes
ONERA, The French Aerospace lab, IMFT
Toulouse, France

Stéphane Vincent
Université Paris-Est, Marne-La-Vallée (UPEM)
France

Udine *May 16 - 20* 2016

SMALL SCALE MODELING AND SIMULATION OF TURBULENT MULTI-PHASE FLOWS

The numerical simulation of multi-phase flows involving immiscible phases or solid particles generally considers the interaction between an ambient fluid and anoter phase (solid particles, droplets, bubbles, films, sprays, jets). Either deformable grids, which are adapted to the interface, or fixed grids, with an independent representation of the interface, such as front-tracking, volume-of-fluid, level-set and phase-field, can be used to investigate these flows. The direct numerical simulation and large eddy simulation of multi-phase flows can be achieved with different mathematical models (Navier-Stokes, Boltzmann, Saint-Venant, Smooth-Particle Hydrodynamics) with emphasis on different physical aspects of the flow

(representation of the capillary force with constant and variable surface tension, phase change, wettability and contact lines, and more complex phenomena involving electric and magnetic fields). Other topics of interest to the mechanical and CFD community are the multi-scale modeling of multi-phase flows.

The present course aims at providing basis and recent research insights concerning the small scale modeling and simulation of turbulent multi-phase flows. By small scale, it has to be understood that the grid size for the simulation is smaller than most of the physical time and space scales of the problem. Small scale modeling of multi-phase flows is a very popular topic since the capabilities of massively

parallel computers allows to go deeper into the comprehension and characterization of realistic flow configurations and at the same time, many environmental and industrial applications are concerned such as nuclear industry, material processing, chemical reactors, engine design, ocean dynamics, pollution and erosion in rivers or on beaches …

The main goal of this course is to propose a complete and exhaustive presentation of models and numerical methods devoted to small scale simulation of turbulent multi-phase flows from specialists of the research community. Attention has also been paid to promote illustrations and applications with senior researchers experts in CFD, multi-phase flows and collaborations with industry.

The idea is also to bring together developers and users of different numerical approaches and codes to share their experience in the development and validation of the algorithms and discuss the difficulties and limitations of the different methods and their pros and cons. The focus will be mainly on fixed-grid methods, however adaptive and unstructured grids will be also partly broached, with the aim to compare and validate the different approaches and models.

PRELIMINARY SUGGESTED READINGS

Vincent S. and Sarthou A. and Caltagirone J.-P. and Sonilhac F. and Février P. and C. Mignot and Pianet G., Augmented Lagrangian and penalty methods for the simulation of two-phase flows interacting with moving solids. Application to hydroplaning flows interacting with real tire tread patterns, J. Comput. Phys., 230, pp. 956-983, 2011.

INVITED LECTURERS

S. Bala Balachandar - University of Florida, Gainesville, FL, USA
7 lectures on: particle interacting with turbulence. Particle/turbulence interactions - Collisions - Resolved scale particles/Lagrangian/Eulerian modeling - Validations - Illustrations.

Jean-Luc Estivalezes - ONERA, The French Aerospace lab, IMFT, Toulouse, France
9 lectures on: massively parallel methods for deformable interfaces. History of interface tracking methods (except VOF) - Level Set -Ghost Fluid - High order finite volume schemes - Projection methods/AMR/parallel aspects - Eulerian/Lagrangian coupling for deformable interfaces - DNS of turbulence with deformable interfaces.

Djamel Lakehal - Ascomp GmbH, Zurich, Switzerland
6 lectures on: deformable interfaces interacting with turbulence. Interaction turbulence/interface - LES for interfaces – Validations - Illustrations.

Ruben Scardovelli - Università di Bologna, Italy
6 lectures on: recent developments of VOF approaches for deformable interfaces. History and recent developments of VOF methods - Divergence free interpolations - Capillary effects/height functions – Validations - Illustrations.

Stéphane Vincent - Université Paris-Est, Marne-La-Vallée (UPEM), France
10 lectures on: fictitious domains for resolved scale multi-phase flows -fluide model - Fictitious domains - Augmented Lagrangian/ penalty methods/vectorial projection - Compressible (low-mach) two-phase flows – Validations - Applications.

LECTURES

All lectures will be given in English. Lecture notes can be downloaded from the CISM web site, instructions will be sent to accepted participants.

SMALL SCALE MODELING AND SIMULATION
OF TURBULENT MULTI-PHASE FLOWS

Udine, May 16 - 20, 2016
Application Form
(Please print or type)

Surname _____

Name _____

Affiliation_____

Address_____

_____

E-mail _____

Phone _____Fax_____

Method of payment upon receipt of confirmation (Please check the box)

The fee is 575,00 Euro + 22% Italian VAT taxes, where applicable (bank charges are not included).

❏ *I shall send a check of Euro _____*

❏ *Payment will be made to CISM - Bank Account No. 094570210900, VENETO BANCA - Udine (CAB 12300 - ABI 05035 - SWIFT/BIC VEBHIT2M - IBAN CODE IT46 N 05035 12300 09457 0210900). Copy of the receipt should be sent to the secretariat*

❏ I *shall pay at the registration counter with check or VISA Credit Card (Mastercard/Eurocard, Visa, CartaSi)*

IMPORTANT: CISM is obliged to present an invoice for the above sum. Please indicate to whom the invoice should be addressed.

Name _____

Address _____

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C.F.*_____

VAT/IVA* No _____
(*) Only for EU residents or foreigners with a permanent business activity in Italy.

Only for Italian Public Companies
❏ *I ask for IVA exemption (ex law n. 537/1993 - art. 14 comma 10).*

Privacy policy: I understand that data received via this form will be used only to provide information about CISM and its activities, within the limits set by the Italian legislative decree no. 196/2003 and subsequent amendments.
Complete information on CISM's privacy policy is available at www.cism.it.

I have read the "Admission and Accommodation" terms and conditions and agree.

Date _____   Signature _____