ADMISSION AND ACCOMMODATION

The course is offered in a hybrid format giving the possibility to attend the course also by remote (on Microsoft Teams platform). On-site places are limited and assigned on first come first served basis.
The registration fees are:

- **On-site participation, 450.00 Euro + VAT***

This fee includes a complimentary bag, four fixed menu buffet lunches (on Friday upon request), hot beverages, downloadable lecture notes.
Deadline for on-site application is March 4, 2022.

- **Online participation online, 200.00 Euro + VAT***

This fee includes downloadable lecture notes.
Deadline for online application is March 25, 2022
Application forms should be sent on-line through the following web site: http://www.cism.it

JMBC participants should contact JMBC before proceeding with registration.

A message of confirmation will be sent to accepted participants.

A limited number of on-site participants can be accommodated at CISM Guest House at the price of 30 Euro per person/night (mail to: foresteria@cism.it).

** where applicable (bank charges are not included)*
Italian VAT is 22%.

CANCELLATION POLICY

Applicants may cancel their registration and receive a full refund by notifying CISM Secretariat in writing (by email) no later than:
- March 4, 2022 for on-site participants (no refund after the deadline);
- March 25, 2022 for online participants (no refund after the deadline).

Cancellation requests received after these deadlines will be charged a 50.00 Euro handling fee. Incorrect payments are subject to Euro 50,00 handling fee.

For further information please contact:
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ACADEMIC YEAR 2022

Centre International des Sciences Mécaniques
International Centre for Mechanical Sciences

COMPLEX FLOWS AND COMPLEX FLUIDS

CISM-JMBC Joint Advanced School
coordinated by

Federico Toschi
TU Eindhoven, The Netherlands

JMBC Representative
Ruud Henkes
TU Delft, The Netherlands

CISM Representative
Alfredo Soldati
TU Wien, Austria

Udine ***April 4 - 8*** **2022**

COMPLEX FLOWS AND COMPLEX FLUIDS

Fluids and fluid flows are everywhere and are key to a vast number of scientific problems and industrial applications. Fluid flows can display extremely different behavior depending on the lengthand time-scale of observation, on the internal fluid structure, on the flow geometry and on the presence of (external) forces.
With the present course we will offer to PhD students and to young researchers the possibility to have a rather complete overview of the different type of behavior that fluids can exhibit under different flowing conditions.
The course will cover from the dynamics of complex fluids to the statistical description of complex flows. In particular, the course will address the physics of yield stress materials, the rheology of dense fluid suspensions, the physics of laminar and turbulent flows, the (turbulent) transport of heat and mass.
Lectures will present the phenomenology, the theoretical framework and where appropriate they will illustrate numerical and experimental approaches.
The organization of the course will combine the expertise of both JBMC and CISM and will address both the Dutch scientific community working on fluid mechanics as well as the international community (CISM).
The course is addressed to PhD students and early-career researchers interested in fluid flows.

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.

INVITED LECTURERS

Roberto Benzi - University of Tor Vergata , Rome, Italy
6 lectures on: Fluid dynamics turbulence
The laminar-turbulent transition, fully developed turbulence, from Kolmogorov 1941 to multifractals; 2d vs. 3d turbulence, turbulent passive scalar. Eulerian vs. Lagrangian turbulence.

Herman Clercx - TU Eindhoven, The Netherlands
6 lectures on: Physics of thermally driven turbulent flows
Physics of thermally driven turbulence flows, instability, Rayleigh-Benard and Rayleigh-Taylor model systems. The GL theory for Rayleigh-Benard and Taylor-Couette systems.

Elisabeth Guazzelli - Laboratoire Matière et Systèmes Complexes, Université Paris Diderot, France
6 lectures on: Rheology of dense particulate systems
Classical rheology of suspensions, rheology of dense suspension and the jamming transition, rheology of suspension in complex fluids and shear thickening.

Detlef Lohse - University of Twente, The Netherlands
6 Lectures on: Physicochemical hydrodynamics
Physicochemical hydrodynamics of bubbles and droplets, Marangoni flow, Plasmonic bubbles, evaporation of complex droplets, fluid dynamical challenges in inkjet printing.

Peter Schall - University of Amsterdam, The Netherlands
4 lectures on: Soft glassy flows
Soft glassy rheology; microscopic picture; the jamming transition; models of soft glassy rheology; nonlocal rheology; foams; open questions.

Federico Toschi - TU Eindhoven, The Netherlands
6 lectures on: From point-wise to complex particles turbulence
Models for particles and bubble dynamics, preferential concentration, small-scale clustering and fractal dimensions; non-spherical particles; numerical techniques; open questions

TIME TABLE

TIME	Monday	Tuesday	Wednesday	Thursday	Friday
	April 4	April 5	April 6	April 7	April 8
9.00 - 9.45		Toschi	Lohse	Clercx	Guazzelli
9.45 - 10.30	Registration	Toschi	Lohse	Clercx	Guazzelli
11.00 - 11.45	Lohse	Lohse	Clercx	Guazzelli	Clercx
11.45 - 12.30	Lohse	Lohse	Clercx	Guazzelli	Clercx
14.00 - 14.45	Benzi	Guazzelli	Benzi	Toschi	
14.45 - 15.30	Benzi	Guazzelli	Benzi	Toschi	
16.00 - 16.45	Toschi	Benzi	Schall	Schall	
16.45 - 17.30	Toschi	Benzi	Schall	Schall	
18.00	Welcome Aperitif				