

## ADMISSION AND ACCOMMODATION

The registration fee is 450.00 Euro + VAT taxes\*, where applicable (bank charges are not included). The registration fee includes a complimentary bag, four fixed menu buffet lunches (on Friday upon request), hot beverages, downloadable lecture notes and wi-fi internet access.

**JMBC participants should contact JMBC before proceeding with registration.**

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>. 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.

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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ACADEMIC YEAR  
2017

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  
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TU Eindhoven, The Netherlands

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TU Wien, Austria

**Udine May 8 - 12 2017**

## 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 length - and 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).

## 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.  
 Specific topics: 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** - Aix-Marseille Univ, CNRS, IUSTI, Marseille, 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.

**Peter Schall** - University of Amsterdam, The Netherlands  
*4 lectures on:* soft glassy flows.  
 Specific topics: Soft glassy rheology; microscopic picture; the jamming transition; models of soft glassy rheology; non- local 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.

## 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.

## TIME TABLE

TIME	Monday	Tuesday	Wednesday	Thursday	Friday
	May 8	May 9	May 10	May 11	May 12
9.00 - 9.45		Roberto Benzi	Elisabeth Guazzelli	Peter Schall	Herman Clercx
9.45 - 10.30	Registration	Roberto Benzi	Elisabeth Guazzelli	Peter Schall	Herman Clercx
11.00 - 11.45	Federico Toschi	Herman Clercx	Roberto Benzi	Federico Toschi	Federico Toschi
11.45 - 12.30	Federico Toschi	Herman Clercx	Roberto Benzi	Federico Toschi	Federico Toschi
14.00 - 14.45	Elisabeth Guazzelli	Elisabeth Guazzelli	Workshop	Peter Schall	
14.45 - 15.30	Elisabeth Guazzelli	Elisabeth Guazzelli	Workshop	Peter Schall	
16.00 - 16.45	Roberto Benzi		Workshop	Herman Clercx	
16.45 - 17.30	Roberto Benzi		Workshop	Herman Clercx	