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<td>July 11</td>
<td>9.00 - 9.45</td>
<td>Registration</td>
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**ADMISSION AND ACCOMMODATION**

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](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.

The 700.00 Euro registration fee includes a complimentary bag, four fixed menu buffet lunches (Friday not included), hot beverages, on-line/downloadable lecture notes and wi-fi internet access.

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. Requests should be sent to CISM Secretariat by May 11, 2011 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.

The Deutscher Akademischer Austausch Dienst (DAAD) and the Deutsche Forschungsgemeinschaft (DFG) offer support to German students. Please contact:

**DAAD**, Kennedyallee 50, 53175 Bonn  
tel. +49 (228) 882-0  
e-mail: postmaster@daad.de  
web site: [http://www.daad.de/de/kontakt.html](http://www.daad.de/de/kontakt.html)

**DFG**, Kennedyallee 40, 53175 Bonn  
tel. +49 (228) 885 2655  
e-mail: ing4@dfg.de  
web site: [http://www.dfg.de](http://www.dfg.de)

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

**For further information please contact:**

**CISM**  
Palazzo del Torso - Piazza Garibaldi 18  
33100 Udine (Italy)  
tel. +39 0432 248511 (6 lines)  
fax +39 0432 248550  
e-mail: cism@cism.it
MECHANICS OF FINE COHESIVE POWDERS

Granular materials are perfect examples of complex systems. The mechanical behavior of a single grain is well understood, yet the behavior of a large collection of grains exhibits a rich variety of yet unexplained phenomena. Complexity is boosted when particle size is decreased below a few tens of microns. Fine powder cohesiveness leads to agglomeration, poor flowability, clumping, difficulty in fluidizing, irregular avalanching behavior, etc. Despite all the inconveniences, fine powder processes pervade the chemical, pharmaceutical, agricultural and mining industries among others. The course will be opened by demonstrating the rich phenomenology exhibited by fine powders, which are particularly characterized by their strong interaction with the surrounding gas and high compactability. A part of the course will be focused on a formal mechanical description and the rheological characterization of fine powders. Dispersion of fine powders, which is a subject of concern in numerous industries, triboelectrification, usually causing dust explosions, and vibration processes, will be particularly considered as phenomena of special relevance in practical applications. A further focus of the course will be a description of modern noninvasive techniques for characterizing the microstructure of fine powders, which allow for a correlation between the microscopic structure and the bulk powder behavior. Understanding the behavior of fine powders is not just relevant for their applications in earth but also for their role in space. This is a nice example that illustrates the highly interdisciplinary nature of the study on powder mechanics. In this context, studying the mechanics of agglomeration of fine particles is of great importance in order to investigate the formation of planetesimals, the kilometer-sized precursors of the solid planetary bodies in our solar system. Common phenomena apply to naturally-occurring particles on earth, in space, or in newly manufactured nanoparticles. An important part of the course will be devoted to current advances on the use of computational tools to predict the behavior of granular materials. Advanced modeling tools, such as Computational Fluid Dynamics and the Discrete Element Method, are highly attractive. Various formulations will be described and their assumptions shown. All practical formulations require closures which will be discussed as a central theme during the course. Gaining an understanding of how and why bulk powder behavior changes as particle size decreases becomes important to researchers in a broader range of applications as more and more manufactured products utilize fine powders. Due to its marked interdisciplinary character, the behavior of fine powders cannot be understood without the sharing of knowledge between specialists on a variety of disciplines. An overall aim of the course is to contribute to develop the capacity of interdisciplinary research fields to understand these complex systems. This course is thus intended for doctoral and postdoctoral academic and industrial researchers in applied physics, mechanical-, chemical- or geotechnical engineering, who are interested in the sharing and integration of knowledge bases from this disparate set of disciplines into a single interdisciplinary subject area oriented to the special characteristics of fine powders.

PRELIMINARY SUGGESTED READINGS

P.J. Armitage, Planet Formation, chapters 1-4 (Cambridge University Press, 2010).

INVITED LECTURERS

José-Manuel Valverde - University of Seville, Spain

Jürgen Blum - Technische Universität zu Braunschweig, Germany

Wim G. Bouwman - Delft University of Technology, The Netherlands

Mohataba Ghadiri - University of Leeds, UK

Berend van Wachem - Imperial College, London, UK

Otis Walton - Grainflow Dynamics Inc., Livermore, CA, USA

LECTURES

All lectures will be given in English. Lecture notes can be downloaded from CISM web site, instructions will be sent to accepted participants.
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 of Euro 700,00 includes IVA/VAT tax and excludes bank charges

☒ I shall send a check of Euro _______________________

☒ Payment will be made to CISM - Bank Account N° 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, cash 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 __________________________________________________________________________________________________
________________________________________________________________________________________________________________
________________________________________________________________________________________________________________
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 ______________________