DIPARTIMENTO DI INGEGNERIA MECCANICA E AEROSPAZIALE

SAPIENZA
UNIVERSITÀ DI ROMA

Best Practice Guidance Seminar

CFD for Dispersed Multi-Phase Flows 2020

With Problem Shooting Session

05. and 06. October 2020, ERCOFTAC PC Italy
Sapienza Università di Roma, Rome, Italy
(Proior to the ERCOFTAC Autumn Festival)

Main lecturers:

Prof. Dr. Berend van Wachem, Mechanical Process Engineering, Otto-von-Guericke University Magdeburg, Germany

Prof. Dr.-Ing. Martin Sommerfeld, Multiphase Flow Systems, Otto-von-Guericke University Magdeburg, Germany

Local lecturers:

Prof. Vincenzo Armenio Ph.D
Dept of Engineering and Architecture, University of Trieste, Italy

Dr. Paolo Venturini, Ph.D.
Dept. of Mechanical and Aerospace Engineering, Sapienza Università di Roma (Italy)

Monday, 05 October 2020

8:30 **Registration and Coffee**

8:45 **Introduction to the course; Characterisation of multiphase flows (30 min); Martin Sommerfeld**

9:15 **Numerical methods for multi-phase flow (45 min) Berend van Wachem**

10:00 **Numerical methods for multi-phase flow (30 min)**
(Lattice-Boltzmann Method) Martin Sommerfeld

10:30 **Refreshments (30 min)**

11:00 **Industrial challenges and needs for the application of CFD to industrial dispersed multiphase flows (60 min) Berend van Wachem**

12:00 **Forces on particles, droplets and bubbles (30 min) Martin Sommerfeld**

12:30 **Lunch (60 min)**

13:30 **Forces on particles, droplets and bubbles (60 min) Martin Sommerfeld**

14:30 **Modelling elementary processes in dispersed multi-phase flows (60 min);**
(wall collisions, inter-particle collisions, agglomeration) Martin Sommerfeld

15:30 **Refreshments (30 min)**

16:00 **Modelling elementary processes in dispersed multi-phase flows (30 min); (non-spherical particles) Berend van Wachem**

16:30 **Numerical simulation of erosion/deposition in a rotating turbomachinery (45 min);**
Paolo Venturini

17:15 **Modelling elementary processes in dispersed multi-phase flows (30 min);**
(droplet collisions) Martin Sommerfeld

17:45 **Q & A (30 min)**

Tuesday, 06 October 2020

8:30 **Euler/Euler approach with applications (60 min);** **Berend van Wachem**

9:30 **Euler/Lagrange method, fundamentals, implementation and coupling (45 min);**
Martin Sommerfeld

10:15 **Refreshments (30 min)**

10:45 **Multiphase models for flow cavitation (45 min);**
Vincenzo Armenio

11:30 **Euler/Lagrange method (45 min);**
Coupled CFD/DEM Simulations **Berend van Wachem**

12:15 **Lunch (60 min)**

13:15 **Euler/Lagrange method applications: pneumatic conveying, agglomeration in a gas cyclone, bubble dynamics in bubbly flows (45 min)**
Martin Sommerfeld

14:00 **Test case calculations and examples of application (30 min);**
Summary of available test cases, channels, jets, sprays, fluidised beds
Martin Sommerfeld

14:30 **Test case calculations and examples of application (30 min);**
Berend van Wachem

15:00 **Refreshments (30 min)**

15:30 **Problem shooting session, presentations from participants (60 min);**
(Registration required, please submit your proposal, we will try our best to help solving your problem)

16:30 **Q & A including refreshments**

17:00 **Closure**

Multiphase Flows Rationale

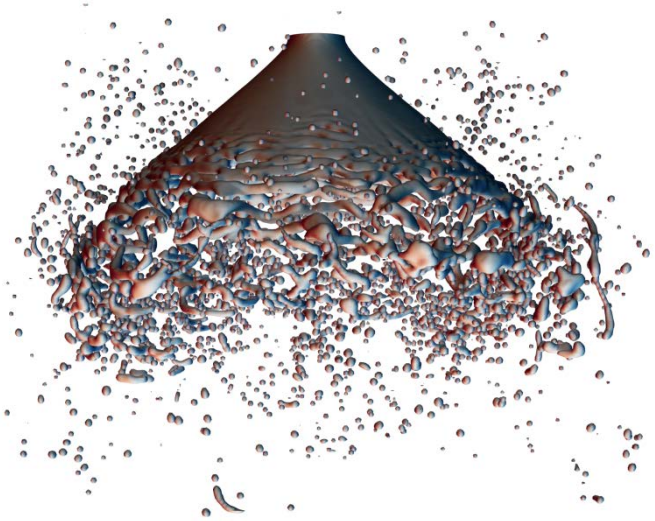
The simultaneous presence of several different phases in external or internal flows such as gas, liquid and solid is found in daily life, environment and numerous industrial processes. These types of flows are termed multiphase flows, which may exist in different forms depending on the phase distribution, such as separated and dispersed systems. Examples are gas-liquid transportation, crude oil recovery, circulating fluidized beds, sediment transport in rivers, pollutant transport in the atmosphere, cloud formation, fuel injection in engines, bubble column reactors and sprays for food processing, to name only a few. As a result of the interaction between the different phases such flows are rather complicated and very difficult to describe theoretically.

Consequently, the numerical calculation of multiphase flow systems based on CFD methods also comprises a multitude of different numerical methods each applicable to certain types of multiphase flows and resolving different length and time scales of the problem. The present course focusses on numerical simulations of dispersed multiphase flows and the required modelling of particle-scale phenomena. The hierarchy of available numerical techniques for the different scales in multiphase flows (i.e. particle-scale and industrial-scale simulations) is presented. Both the well-known Euler/Euler and Euler/Lagrange approach, suitable for large-scale simulations of industrial processes, are introduced in detail. Required modelling for particle-scale transport phenomena is presented and the use of particle-resolved direct numerical simulations for their development is emphasised. Examples of a number of advanced models are presented and their effects on large-scale processes are highlighted.

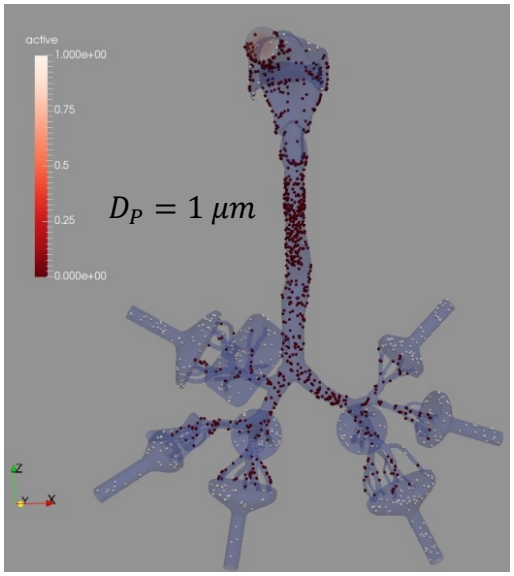
This course is rather unique as it is one of few in the community that is specifically designed to deliver, a) best practice guidance and b) the latest trends in CFD for dispersed multi-phase flows and c) many application examples.

The course appeals to researchers and engineers involved in projects requiring CFD for (wall-bounded) turbulent dispersed multi-phase flows with bubbles, drops or particles.

Moreover, delegates are offered the opportunity to present their work via 10 minute presentations (problem-shooting session), thereafter, the lecturers can offer prospective solution. Registration is required: martin.sommerfeld@ovgu.de.



A hybrid Eulerian/Lagrangian simulation of an atomising spray.



Euler/Lagrange results for particle deposition in a lung model (dark particles: deposited; grey particles: still active particles)

Registration: ERCOFTAC CADO: admin@cado-ercoftac.org

Registration Fees
(a reduction of 50 € applies to ERCOFTAC members)

Deadline for registration: 15. August 2020
Industry: 650 €
Academia: 450 €
PhD Students: 300 €

Each delegate will receive a free copy of the book BPG CFD for Dispersed Multiphase Flows, lunches and coffee breaks are included.

Please note, course fees do NOT include accommodation.

All locally valid contact restrictions as a consequence of the Corona Virus have to be respected during the course. The requirements on the size of the lecture room are respected. We appreciate your understanding and your support.

http://www.ercoftac.org/

Address of the Event:

Faculty of Civil and Industrial Engineering,
Sapienza Università di Roma
Via Eudossiana 18, 00184, Rome, Italy