Best Practice Guidance Seminar

CFD for Dispersed Multi-Phase Flows 2019

With Problem Shooting Session

17. and 18. May 2019, ERCOFTAC PC Brazil
Hotel Windsor Barra, Barra da Tijuca, Rio de Janeiro, Brazil

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

Additional lecturers:

Prof. Fernando Luiz Sacomano Filho, Universidade de São Paulo, Escola Politécnica da USP, Brazil

Prof. Paulo Laranjeira da Cunha Lage, Chemical Engineering Program at COPPE, Universidade Federal do Rio de Janeiro, Brazil

Friday, 17 May 2019

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 **Population balance modeling (45 min);**
Paulo Laranjeira da Cunha Lage

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

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

Saturday, 18 May 2019

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 **Sprays with heat and mass transfer and combustion (45 min);**
Fernando Luiz Sacomano Filho

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.

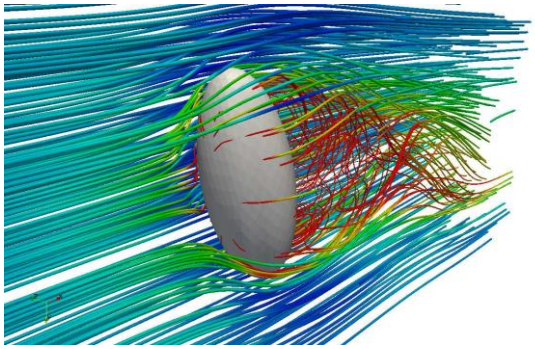
Consequently, the numerical calculation of multiphase flow systems based on CFD methods also comprises a multitude of different numerical methods each applicable to certain types of multiphase flows and resolving different length and time scales of the problem. The present course focusses on numerical 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.

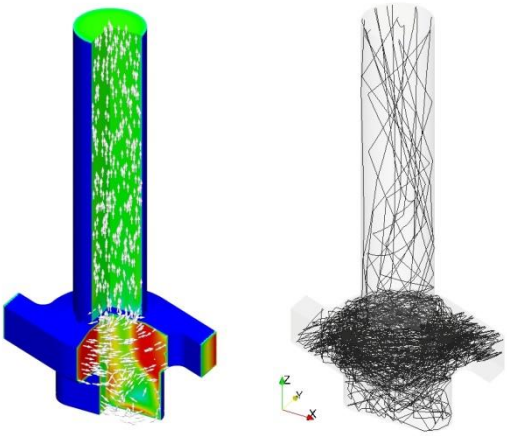
The course appeals to researchers and engineers involved in projects requiring CFD for (wall-bounded) turbulent dispersed multi-phase flows with bubbles, drops or particles.

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.

Resolved DNS: Flow about an ellipsoid



Euler/Lagrange: Swirl-type inhaler



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

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

Deadline for registration: 15. March 2019
Industry: 600 €
Academia: 400 €
PhD Students: 250 €

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.

http://www.ercoftac.org/