Best Practice Guidance Seminar

CFD for Dispersed Multi-Phase Flows 2018

With Problem Shooting Session

15. and 16. October 2018, Centre for Innovation and Technology Transfer Management of Warsaw University of Technology, Rektorska St. 4, Warsaw, Poland

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

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. Dr. Ruud Henkes, Delft University of Technology and Shell Projects & Technology, The Netherlands

Prof. Jerzy Baldyga, Faculty of Chemical and Process Engineering, Warsaw University of Technology, Poland

Dr. Darek Asendrych, Czestochowa University of Technology, Poland

Monday, 15 October 2018

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), Ruud Henkes, Shell Research**

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); (inter-particle collisions and 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 **Flow modelling of concentrated fibre suspensions (30 min); Darek Asendrych, CzUT, Czestochowa, Poland**

17:00 **Modelling elementary processes in dispersed multi-phase flows (30 min); (droplet collisions and bubble coalescence) Martin Sommerfeld**

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

Tuesday, 16 October 2018

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

9:30 **Dilute and concentrated emulsions in agitated systems (45 min);**
Jerzy Bałdyga, WUT, Warsaw, Poland

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

10:45 **Euler/Lagrange method, fundamentals, implementation and coupling (45 min);**
Martin Sommerfeld

11:45 **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 and erosion, agglomeration in spray drying, bubble dynamics in bubble column (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

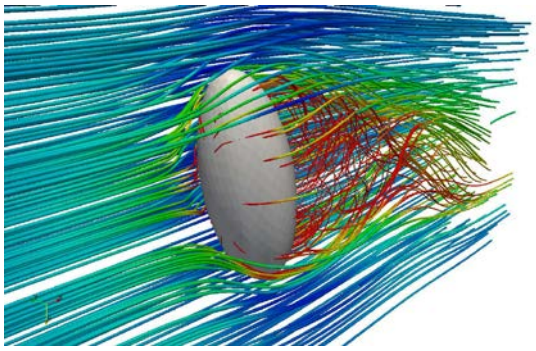
15:00 **Refreshments (30 min)**

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)

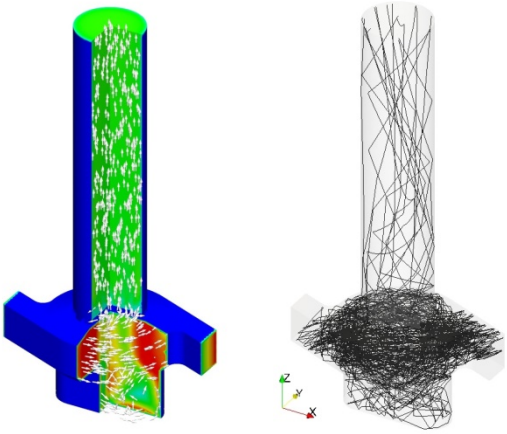
16:30 **Q & A including refreshments**

17:00 **Closure**

Resolved DNS: Flow about an ellipsoid



Euler/Lagrange: Swirl-type inhaler



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. 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 spray 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 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 approaches for particle-scale transport phenomena are presented and the use of fully resolved direct numerical simulations for their development is emphasised.

This course is rather unique as it is one of few in the community that is specifically designed to deliver, a) 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.

Fees (reduction ERCOFTAC members 50 €):
Industry: 600 €
Academia: 400 €
PhD Students: 250 €

Please note Course fees do NOT include accommodation

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

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http://www.ercoftac.org/