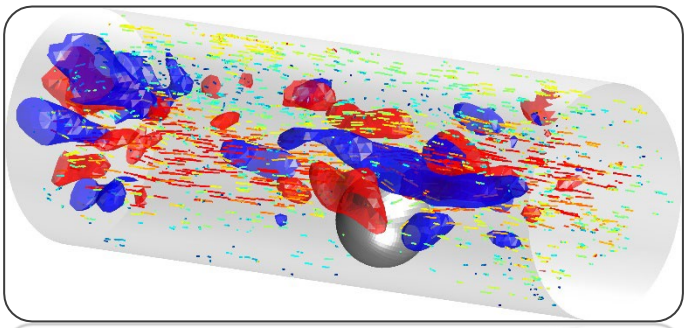
Universität Bremen

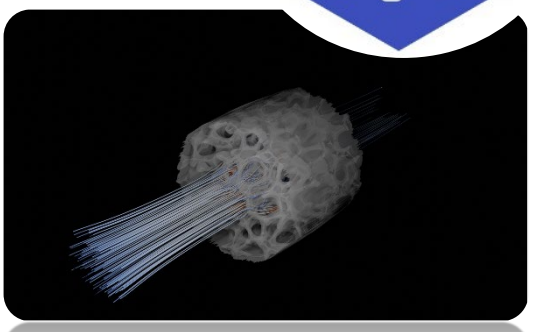
MAPEX Center
for Materials and Processes

PROGRAMME

4th MAPEX Methods Workshop ‘Fluid Dynamics’

12th May 2022
AIB Building (Hochschulring 40)





MAPEX Bremen

Programme

Session 1	
	Welcome
10:00	**Introduction to computational fluid dynamics** Marc Avila *ZARM, University of Bremen*
10:30	**Molecular and solid particle diffusion - micro and multiphase flow equivalence and difference** Rodion Groll *ZARM, University of Bremen*
11:00	***Discussion and coffee break***
Session 2	
11:30	**Investigation of reactive gas flows with nuclear magnetic resonance imaging and computational fluid dynamics.** Georg Pesch *UFT, University of Bremen*
12:00	**Multiphase Flows (Bubbles, Drops and Particles)** Udo Fritsching *Leibniz IWT, Process and Chemical Engineering*
12:30	***Poster session and finger food for lunch***
Session 3	
14:00	**Introduction to experimental fluid dynamics** Andreas Fischer *BIMAQ, University of Bremen*
14:30	**Tailoring feedstock rheology for 3d printing** Michael Maas *Ceramics, University of Bremen*

15:00	***Discussion and coffee break***

Session 3

15:30	**Finding key observables in fluid flows: from visualizations of sloshing liquids to 4D-measurements in particle-laden flows** Kerstin Avila *Leibniz IWT, Process and Chemical Engineering*
16:00	**Microfluidics** Michael Vellekoop *IMSAS, University of Bremen*

16:30	***Poster session with beer and pretzels***

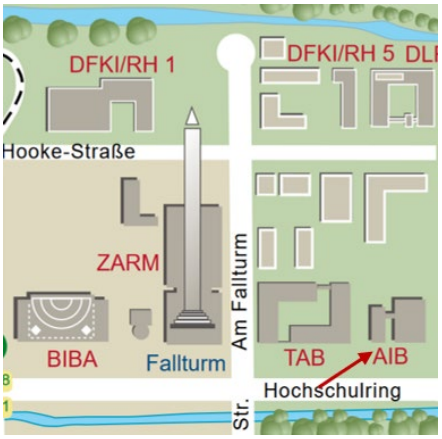
18:00	***End of programme***

Venue

AIB building

Hochschulring 40

First floor



Organizing committee

Scientific chairs: Marc Avila, Georg Pesch

Workshop organization: Hanna Lührs

Support: Britta Hinz, Jan Eggert, Guilherme Dalla Lana Semione, Saeideh Nazeri, Bastian Dincher (photographer)

Cover images provided by: left: Kerstin Avila, right: Georg Pesch

Posters

P01 Development of a CFD Model for Investigating the Protein Digestion in Human Stomach

Changyong Li
FB04, University of Bremen

Understanding gastric digestion mechanisms is important for the design of functional foods. In this study, we have investigated the meat-protein digestion in human-stomach by using a CFD method. The gastric motility is modeled with a dynamic mesh. The disintegration of large food particles in an acidic environment is simulated using a reaction-diffusion-convection model. A food matrix is used to model the large food-particles.

P02 Experimental study of mixing dynamics in a T-shaped mixer

Huixin Li
University of Bremen, ZARM

Fluid mixing is ubiquitous and indispensable in chemical processes and engineering applications, e.g., chemical synthesis and particle synthesis. This study experimentally investigates the mixing dynamics in a T-mixer at a high Schmidt number ($Sc \gg 1$) for different Reynolds numbers. The accurate measurements of small-scale dynamics and scale interactions by non-intrusive techniques, i.e. particle image velocimetry (PIV) and planar laser-induced fluorescence (PLIF), will facilitate the understanding of the mixing, especially between the smallest velocity lengthscales (Kolmogorov scale) and the smallest scalar lengthscales (Batchelor scales). The larger dimensions of our T-mixer with a height of centimeters, beyond the dimensions of mostly used micro-scale T-mixer in the same geometry, makes the accuracy of proposed measurements reachable.

P03 Master Thesis: Minimum Quantity Lubrication during Vibration-Assisted Drilling

Johnson David Hatscher
University of Bremen, IWT

Minimum quantity lubrication (MQL) can efficiently reduce friction and remove heat during drilling processes, but few studies exist elucidating the underlying flow dynamics. In our work the two-phase MQL is supplied through internal channels within the drilling bit and directly released at the cutting zone. Digital image analysis of high-speed recordings of the MQL flow reveal three different dynamical regimes. The pulsed MQL flow seems to be ideally suited for vibration assisted drilling.

P04 Sloshing experiments pave the way to predict resonances

Bastian Bäuerlein
University of Bremen, IWT

Resonances of sloshing liquids can become a threat to e.g. tankers transporting liquified natural gas and are notoriously difficult to predict. Our analysis of the liquid's center of mass motion allows an unmatched comparison to mechanical mass-spring and modern sloshing models. An excellent prediction of the nonlinear resonances was finally achieved in collaboration with theoreticians (ETH Zürich) by combining dynamical systems theory with a data-driven machine learning algorithm.

P05 Reactive CFD and NMR: Bringing research areas together for detailed, full-field validation

Kevin Kuhlmann
FB04, University of Bremen

Multiscale CFD simulations give new possibilities for the detailed analysis of reactor setups and reactions occurring within catalytic reactors, which is hardly possible with experimental methods. Here, we propose a new, additively manufactured reactor design for the validation of the Pt-catalyzed ethylene hydrogenation reaction at high spatial resolution. The digital reactor geometry is the basis for reactive CFD simulations implementing a microkinetic model from literature.

P06 Rheology and fluid simulation of non-Newtonian adhesives

Marvin Kaufmann
Fraunhofer IFAM

Adhesive research is shifting towards more process-oriented problems, besides the widely investigated stress and strength related topics. This global view on adhesive bonding includes the consideration of adhesive flow during application and joining of the substrates. This requires professional handling of bonding problems and the ability to determine parameters such as the flow characteristics, e.g. viscosity-laws, of non-Newtonian fluids.

P07 Aerodynamic Devices to Reduce/Suppress Vortex Induced Vibrations on a Wind Turbine Tower: A Review

Likith Krishnappa
University of Bremen

Vortex Induced Vibrations (VIVs) can induce very high fatigue loads onto the wind turbine towers, leading to its failure. Hence, the suppression/ mitigation of these VIV's is of utmost importance in practical situations. This work focuses on providing a brief overview on the available passive techniques with particular interest in the flow modification, flow separation control devices and their implementation on a wind turbine tower.

P08 A Discrete Differential Geometric Formulation of Multiphase Surface Interfaces for Scalable Multiphysics Equilibrium Simulations

Stefan Endres
University of Bremen, IWT

In many multiphase systems where surface tension forces dominate over viscous forces, the model can be reduced to a surface interface curvature-driven mechanical problem. In such systems an accurate estimate of the mean curvature of phase interfaces is essential. A generalised discrete differential geometric formulation can be used to reconstruct the exact mean normal curvatures of convex interfaces in equilibrium and to greatly reduce the computational resources required in such simulations.

Participants

1. **Johannes Arndt**, University of Bremen, IWT
2. **Kerstin Avila**, FB04, IWT
3. **Marc Avila**, ZARM, University of Bremen
4. **Bastian Bäuerlein**, University of Bremen, IWT
5. **Ralf Bergmann**, BIAS
6. **Enis Bicer**, MAPEX
7. **Lizoel Buss**, Leibniz IWT
8. **Srinath Chanda**, FB04, University of Bremen
9. **Simone Colantoni**, FB04, University of Bremen
10. **Pedro Henrique da Rosa Braun**, FB04, University of Bremen
11. **Guilherme Dalla Lana Semione**, MAPEX Core Facility
12. **Jan Dietrich**, University of Bremen, FIBRE
13. **Bastian Dincher**, Photographer
14. **David Droste**, FIBRE
15. **Jan Eggert**, MAPEX
16. **Stefan Endres**, University of Bremen, IWT
17. **Amogh Esham**, FB04, University of Bremen
18. **Björn Espenhahn**, University of Bremen
19. **Ana Luiza Fiates**, FB1 - IMSAS
20. **Andreas Fischer**, FB04, University of Bremen
21. **Natalia Fontao**, FB04, University of Bremen
22. **Udo Fritsching**, FB04, University of Bremen
23. **Jasper Giesler**, FB04, University of Bremen
24. **Rodion Groll**, ZARM, University of Bremen
25. **Johnson David Hatscher**, University of Bremen, IWT
26. **Britta Hinz**, MAPEX
27. **Marvin Kaufmann**, Fraunhofer IFAM
28. **Philip Kemper**, UFT, University of Bremen
29. **Patrick Keuchel**, FB04, University of Bremen
30. **Johannes Kiefer**, FB04, University of Bremen
31. **Jagadeesh Kota**, FB04, University of Bremen
32. **Likith Krishnappa**, University of Bremen
33. **Kevin Kuhlmann**, FB04, University of Bremen
34. **Lasse Langstädtler**, FB04, University of Bremen
35. **Changyong Li**, FB04, University of Bremen
36. **Huixin Li**, University of Bremen, ZARM
37. **Hanna Lührs**, MAPEX
38. **Michael Maas**, FB04, University of Bremen
39. **Saeideh Nazeri**, MAPEX
40. **Chris Ohlrogge**, University of Bremen
41. **Georg Pesch**, FB04, University of Bremen
42. **Feixiong Rao**, FB04, University of Bremen
43. **Kurosch Rezwan**, FB04, University of Bremen
44. **Larissa Richter**, FB04, University of Bremen
45. **Lukas Schumski**, Leibniz IWT
46. **Dirk Stöbener**, FB04, BIMAQ
47. **Michael Vellekoop**, FB01, University of Bremen
48. **Hannah Zindel**, MAPEX

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MAPEX Methods Workshop ‘Fluid Dynamics’

Scientific equipment and methods often act as a nucleus for cooperative projects. The MAPEX Methods Workshops offer a platform for information and exchange on the scientific equipment and expertise available within the MAPEX community.

We will provide the audience with an overview about the expertise in the fields of computational and experimental fluid dynamics, available within the MAPEX community. The contributions will be comprehensive overviews in a lecture style with focus on the description of methods and application examples from research.

Two poster sessions will allow for deeper discussions of recent research projects.

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