



Holger Marschall

Curriculum Vitæ

Personal Details

Name Holger Marschall
Date of Birth 1980-07-19
Place of Birth Schramberg, Germany
Marital Status married, two children (2014, 2018)
Citizenship German

Professional Details

Position Head of Research Group "Computational Multiphase Flow"

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Career

since 01/2011

Research Group Leader & Postdoctoral Research Associate, Technische Universität Darmstadt, Thermo-Fluids & Interfaces, Computational Multiphase Flow, Mathematical Modeling and Analysis (Prof. Dr. rer. nat. Dieter Bothe).

02/2007–12/2010

Scientific Assistant & PhD Student

Technische Universität München, Catalysis Research Center, Chair of Chemical Engineering (Prof. Dr.-Ing. Olaf Hinrichsen).

*Dr.-Ing. Holger Marschall – Research Group Leader
Computational Multiphase Flow – Thermo-Fluids & Interfaces
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Education

Academic Education

2007 – 2011 Doctorate

Doctoral Research Qualification

12/2011

Dr.-Ing., *Technische Universität München*, Munich, grade 1.0.

Doctor degree from Technische Universität München, Doktor-Ingenieur (predicate 'passed with distinction', 'summa cum laude'). PhD Thesis entitled 'Towards the Numerical Simulation of Multi-Scale Two-Phase Flows'.

02/2007–12/2010

Scientific Assistant & PhD Student, *Technische Universität München, Catalysis Research Center*, Chair of Chemical Engineering (Prof. Dr.-Ing. Olaf Hinrichsen).

2001 – 2006 Academic Education

Professional Qualification

11/2006

Dipl.-Ing., *Technische Universität München*, Munich, grade 1.5.

Diploma degree from Technische Universität München, Diplom-Ingenieur Univ. (predicate 'very good').

04–10/2006

Diploma Thesis, *BASF SE (Ludwigshafen)*, grade 1.0.

Diploma Thesis entitled 'Modeling of a microstructured gas-liquid distributor using Computational Fluid Dynamics'.

10/2001–11/2006

Diploma Study Course Chemical Engineering (Diplomstudiengang Chemieingenieurwesen), *Technische Universität München*, Munich.

School Education

06/2000

Abitur (A-level), *Mathematisch-Naturwissenschaftliches Gymnasium Spaichingen (maths and natural science grammar school)*, grade 1.1.

Degree with general matriculation standard, Predicate 'passed with distinction' (Allgemeine Hochschulreife, Prädikat 'mit Auszeichnung bestanden').

01/1993–06/2000

Mathematisch-Naturwissenschaftliches Gymnasium Spaichingen (maths and natural science grammar school), Baden-Württemberg.

08/1991–01/1993

Progymnasium (secondary school) in Gosheim, Baden-Württemberg.

08/1987–07/1991

Grundschule (primary school) in Wehingen, Baden-Württemberg.

Research

Research Statement

In my research, methods for the computer-aided prediction of **transport processes in multiphase flows of thermo-fluids** are developed. Simulation methods are implemented in the Open Source C++ Library **OpenFOAM®**. My research is focussed on transport processes & physicochemical phenomena at interfaces and aims at the development of high-fidelity numerical methods to cope with associated challenges.

Research Topics

- *Interfacial mass transfer across fluid interfaces*
- *Complex wetting (surfactants, porous media)*
- *Multicomponent multiphase flow of miscible systems*
- *Viscoelastic two-phase flows at high Weissenberg numbers*

Method Development

- Sharp & diffuse interface capturing methods
- Moving mesh interface tracking methods
- Fluid structure interaction
- adaptive and hybrid approaches

Collaborative Research

Scientific Roles in Research Network Programmes & Institutions

- **German Research Foundation (DFG): Collaborative Research Centre SFB 1194** *Mutual Influence of Wetting and Transport Processes*, www.sfb1194.tu-darmstadt.de; Principal Investigator.
- **German Research Foundation (DFG): Transregio Collaborative Research Centre TRR-SFB 150** *Turbulent, chemically reactive, multi-phase flows near walls*, www.trr150.tu-darmstadt.de; Principal Investigator.
- **German Research Foundation (DFG): Priority Programme SPP 1740** *Influence of Local Transport Processes on Chemical Reactions in Bubbly Flows*, www.dfg-spp1740.de; Principal Investigator.
- **Federal Ministry of Education and Research (BMBF): PrometH₂eus** *Project network for optimised material development for technical H₂ generation through improved oxygen electrodes (Projektverbund zur optimierten Materialentwicklung für die technische H₂-Erzeugung durch verbesserte Sauerstoffelektroden)*; Principal Investigator.
- **EU H2020: exaFOAM** *Exploitation of Exascale Systems for Open-Source Computational Fluid Dynamics by Mainstream Industry*; Principal Investigator (50%, jointly with Prof. Dr. Christian Bischof, Scientific Computing, TU Darmstadt).
- **NHR: NHR4CES** *National High Performance Computing Center for Computational Engineering Sciences: Simulation and Data Laboratory (SDL) Energy Conversion*, www.nhr4ces.de; Principal Investigator.

Awards and Recognition

2018/19 **Visiting professor** at the Institut de Mécanique des Fluides de Toulouse (IMFT), France

- 2012 **Academic Distinction for High-Level Research Work:** Top-Three Young Researchers 2012, *Adolf-Messer-Prize 2012*
- 2001 A-level **Physics Prize – Membership in German Physics Society** (Abiturpreis Physik – Mitgliedschaft in der Deutschen Physikalischen Gesellschaft)

Memberships in Scientific Committees & Professional Bodies

Membership in Editorial Boards & Scientific Committees

- since 2021 Founding Board Member and Editor of the OpenFOAM Journal
- since 2019 Associate Editor of the Canadian Journal of Chemical Engineering
- since 2015 Assigned Member of the DECHEMA ProcessNet Committee Computational Fluid Dynamics
- since 2010 Member of the OpenFOAM Workshop Committee, active in organizing the world's largest community-driven OpenFOAM event

Organization of Scientific Events

- 2019/20 Symposium "Multiscale and Multiphase Flows" (joint with Prof. Dr. Hrvoje Jasak), 14th World Congress in Computational Mechanics and ECCOMAS Congress, Paris, France
- 2019/20 HPC Asia 2020, Workshop "Multi-scale, Multi-physics and Coupled Problems on highly parallel systems(MMCP)", Fukuoka, Japan
- 2019 33rd IEEE Int. Parallel & Distributed Processing Symposium (IPDPS), Workshop on "Performance and Software Engineering in Scientific Computing", Rio de Janeiro, Brazil
- 2014 2nd Int. Conf. on Numerical Methods in Multiphase Flow (joint with Prof. Dr. Dieter Bothe), Darmstadt, Germany
- 2014 2nd Int. Symposium on Multiscale Multiphase Process Engineering (MMPE2), Hamburg, Germany
- 2012 7th OpenFOAM Workshop (OFW7), Darmstadt, Germany
- 2012 Symposium on Numerics for Interfacial Multiphysics with OpenFOAM
- since 2009 OpenFOAM user group meetings for Southern Germany (Munich and Darmstadt, Germany)

Membership in Professional Bodies

- since 2007 Verband Deutscher Ingenieure (The Association of German Engineers, VDI) – VDI-Gesellschaft Verfahrenstechnik und Chemieingenieurwesen (VDI Society for Process and Chemical Engineering, VDI-GVC)
- since 2007 Gesellschaft für Chemische Technik und Biotechnologie e.V. (Society for Chemical Engineering and Biotechnology, DECHEMA)
- 2000–2006 Deutsche Physikalische Gesellschaft (German Physics Society, DPG)

Reviewer & Referee Activities

I am acting as reviewer for research grant proposals submitted to the *German Research Foundation (Deutsche Forschungsgemeinschaft, DFG)*.

Moreover, I am acting as reviewer for the following journals in my field:

- *American Institute of Chemical Engineers (AIChE) Journal,*
- *Applied Mathematical Modelling,*
- *Canadian Journal of Chemical Engineering,*
- *Chemical Engineering Science,*
- *Chemical Engineering Technology & Chemie Ingenieur Technik,*
- *Computers & Fluids,*
- *Computer Physics Communications,*
- *International Journal of Computational Fluid Dynamics,*
- *International Journal of Computational Physics,*
- *International Journal of Heat and Mass Transfer,*
- *International Journal of Multiphase Flow,*
- *International Journal for Numerical Methods in Fluids,*
- *International Journal for Numerical Methods in Engineering,*
- *Journal of Colloid and Interface Science,*
- *Journal of Non-Newtonian Fluid Mechanics,*
- *Journal of Computational Science,*
- *Microfluidics and Nanofluidics,*
- *Oil & Gas Science and Technology.*
- *SoftwareX,*

I am also reviewing scientific proposals submitted to the local HPC council for resources at the university HPC cluster Lichtenberg-I/II (Tier-2).

Professional Expertise

Computer skills

CFD	OpenFOAM, OpenFVM, ANSYS CFX, Comsol Multiphysics/FEMlab.
Programming	C++, Fortran, Turbo Pascal, Delphi.
Techniques and Methods	Unified Modeling Language (UML, ISO/IEC 19501:2005), Doxygen Documentation, Waterfall, Agile(Scrum).
Scientific Libraries	gsl (GNU Scientific Library: wide range of mathematical routines), vnl (Vision Numerics Libraries: numerical containers and algorithms), eigen (C++ class library for linear algebra), blitz++ (C++ class library for scientific computing).
Scripting	Python, bash, Scilab.
Mathematics	Maple, Scilab.
Meshing	blockMesh, Salome, snappyHexMesh, Gmsh, MeshLab.
Data Visualization	ParaView, gnuplot, Origin, Blender (sim-physics), Salome.
Process Engineering	Aspen, gPROMS, ChemCAD, Caesar II, PDS.
Other Software	Eclipse IDE, GIT, TortoiseGit, SVN, TortoiseSVN, GNU gcc, g++, LaTeX, MS Office, LibreOffice, ChemOffice, Gimp, Inkscape.
Operating Systems	Linux, Windows.

Language Skills

German	Fluent (native language)
English	Fluent
Chinese	Basics (1 year university course)
Courses	English for Technical Purposes, International Business English
Assessment	Self-assessment of language proficiency according to the <ul style="list-style-type: none">○ Interagency Language Roundtable (ILR) scale: German (Level 5), English (Level 5), Chinese (Level 1).○ Common European Framework of Reference for Languages (CEFR): English (C2), Chinese (A1).

Teaching

Supervision of Ph.D. & Graduate Student Projects

Supervisor and Principal Investigator

Technische Universität Darmstadt, Thermo-Fluids & Interfaces, Computational Multiphase Flow Group

- *Numerical Simulation of Drop-Wall Film Interaction of Miscible Liquids* (M.Sc. Milad Bagheri)
- *Scale-bridging Simulation of Dynamic Wetting based on the Phase-Field Method* (M.Sc. Francisco Bodziony)
- *Arbitrary Lagrangian-Eulerian Interface-Tracking and Generalised Immersed Boundary Methods* (M.Sc. Heba Alkafri)
- *Development and Application of a Direct Numerical Method for Reactive Transport Processes in Bubble Systems* (M.Sc. Dennis Hillenbrand)

Technische Universität Darmstadt, Thermo-Fluids & Interfaces, Mathematical Modeling and Analysis (Prof. Dr. Dieter Bothe)

- *Direct Numerical Simulation of Locally Coupled Interfacial Transport Processes at Contact Lines during Dynamic Wetting Processes* (M.Sc. Dirk Gründing)
- *Development and Application of a Direct Numerical Method for Reactive Transport Processes in Bubble Systems* (M.Sc. Manuel Falcone)

Co-supervisor and Participating Investigator

Technische Universität Darmstadt, Thermo-Fluids & Interfaces, Mathematical Modeling and Analysis (Prof. Dr. Dieter Bothe)

- *Numerical Simulation of Multicomponent Surfactant Transport on Fluidic Interfaces with OpenFOAM* (M.Sc. Chiara Pesci & Dipl.-Ing. Kathrin Dieter-Kissling)
- *Advanced Volume-of-Fluid Methods on Unstructured Meshes in OpenFOAM with Applications to Fluid Interfaces* (M.Sc. Tomislav Marić)
- *Modeling and Numerical Simulation of Multi-component Two-Phase Fluid Systems with Ionic Species* (M.Sc. Paul Weber)
- *Interfacial Mass Transfer for implicit algebraic Volume-of-Fluid methods* (Dipl.-Ing. Daniel Deising)
- *Numerical Simulation of Viscoelastic Two-Phase Flows* (M.Sc. Matthias Niethammer)

Technische Universität München, Department of Mechanical Engineering, Chair of Plant and Process Engineering (Prof. Dr. Harald Klein)

- *Interfacial Mass Transfer into Liquid Films in Complex Geometries (M.Sc. Simon Hill)*

Karlsruhe Institute for Technology, Institute of Catalysis Research and Technology (Dr. Martin Wörner); BOSCH GmbH, Corporate Sector for Research and Advance Engineering (Dr. Thomas Kiedrowski); Technische Universität Dresden, Institute of Manufacturing Science and Engineering (Prof. Dr. Andrés F. Lasagni)

- *Positive effect on performance by means of active lubricant transport in laser textured surfaces (M.Sc. Tobias Stark)*

Supervision of M.Sc. & Undergraduate Student Projects

Co-supervisor – Numerical Studies

Politecnico di Torino, Dipartimento di Ingegneria Aeronautica e Spaziale (Ass. Prof. Dr. Renzo Arina)

- *Coupled Numerical Simulation of Dynamic Wetting Processes and Fluid-Structure-Interaction using OpenFOAM (B.Sc. Greta Raina, B.Sc. Roberto Detomaso)*

Karlsruhe Institute for Technology, Institute of Fluid Mechanics & Institute of Catalysis Research and Technology (Prof. Dr. Bettina Frohnafel & Dr. Martin Wörner); BOSCH GmbH, Corporate Sector for Research and Advance Engineering (Dr. Alexander Eifert)

- *Direct numerical simulation of transient wetting processes in complex sealing gap geometries using phaseFieldFoam/OpenFOAM (B.Sc. Daniel Hagg)*

Technische Universität Darmstadt, Thermo-Fluids & Interfaces, Nano- and Microfluidics (Prof. Dr. Steffen Hardt)

- *Description of Marangoni-induced Flow Patterns through Photo-switchable Surfactants by means of Direct Numerical Simulation using OpenFOAM (cand. ing. Maximilian Hartmann)*

Co-supervisor – Numerical Studies

Technische Universität München, Department of Chemistry, Chair of Chemical Engineering (Prof. Dr. Olaf Hinrichsen)

- *Numerical Simulation of Viscoelastic Free-Surface Flows using Computational Fluid Dynamics (cand. ing. Florian Habla)*
- *Thermo-fluiddynamic Simulation of Vapour/Steam-Liquid Mixture in Stratified Flow Systems in Horizontal Channels with CFD (cand. ing. Claude Labonte)*

- *Development and Implementation of the Volume-of-Fluid Method with Geometric Interface Reconstruction on Arbitrary Unstructured Meshes for Incompressible Free-Surface Flows using OpenFOAM* (cand. ing. Tomislav Marić)
- *Numerical Simulation of Dispersed Gas-Liquid Flows in Bubble Columns at High Gas Fractions* (German: *Numerische Simulation disperser Gas-Flüssig-Strömungen in Blasensäulen bei hohen Gasphasenanteilen*) (cand. ing. Robert Mornhinweg)
- *Numerical Simulation of Polydisperse Bubbly Flows with Averaged Bubble Number Density and Interfacial Area Concentration Concepts* (cand. ing. Sebastian Oberhauser)
- *Numerical Simulation of Fluidized Beds using the Two-Fluid Model* (Christian Albert)
- *Numerical Simulation of Free-Surface Flows in OpenFOAM with Focus on Validation and Verification* (Thomas Bartesch)
- *Critical Review and Scientific Assessment of Piecewise Linear Interface Calculation on Polyhedral Meshes* (Bruno Beban)
- *Numerical Modeling of Chemical Reactors with OpenFOAM* (Johanna Hable)
- *Numerical Simulation of Bubble Dynamics in Pure and Contaminated Systems with OpenFOAM* (Korbinian Hinterberger)
- *Simulation and Modeling of Fluid Dynamics in Bubble Swarms in the Two-Fluid Model framework using Computational Fluid Dynamics* (German: *Simulation und Modellierung der Fluidodynamik in Blasenschwärmen auf Basis des Zwei-Fluid-Modells mittels der Computational Fluid Dynamics*) (Andreas Kossmann)
- *Analysis of the Object-Oriented Programme and Data Structure of OpenFOAM as Exemplified in the Top-Level Flow Solver *simpleFoam** (German: *Untersuchung zur objekt-orientierten Programm- und Datenstruktur von OpenFOAM am Beispiel des Strömungslösers *simpleFoam**) (Georg Rauch)
- *Numerical Simulation and Modeling of Species Transfer across Fluid Interfaces using Computational Fluid Dynamics* (Christian Schüler)

Co-supervisor – Experimental Studies

Technische Universität München, Department of Chemistry, Chair of Chemical Engineering (Prof. Dr. Olaf Hinrichsen)

- *Design and Installation of a Videometrical Measurement System for Capturing Transient Polydispersed Multiphase Flows in Bubble Columns using a High-Speed Camera* (German: *Entwicklung und Implementierung eines videometrischen Messsystems zur Erfassung transienter, polydisperser Mehrphasenströmungen in Blasensäulen mittels High-Speed-Kamera*) (cand. ing. Florian Kraus)

- *Design and Installation of a Measurement System for Capturing Transient Poly-dispersed Multiphase Flows in Bubble Columns using Modern Pressure Sensors* (German: *Entwicklung und Implementierung eines Messsystems zur Erfassung transienter, polydispenser Mehrphasenströmungen in Blasensäulen mittels moderner Drucksensorik-Verfahren*) (Anna Reif)

Keynotes & Invited Talks

- 2021 **Towards a Unified Diffuse Interface Phase-field Framework for Multiphase Multi-component Fluid Flow**, Invited Talk at the 5th German OpenFOAM User meeting, March 24, 2021, Rostock, Germany.
- 2020 **Simulation of Droplet Impact at High Dynamics using a Diffuse Interface Phase-Field Method in OpenFOAM**, Invited Keynote at the International Conference on Advances in Differential Equations and Numerical Analysis, October 12 - 14, 2020, IIT Guwahati, India.
- 2019 **Scale-bridging interface-resolving simulation of reactive bubble flow**, Invited Keynote at the joint workshop on "Recent advances in bubble columns" of the EFCE Working Party "Multiphase Fluid Flow" and the SFGP (Societe française de Génie des Procédés, France) Working Group "Reactor and Reactor Intensification", November 5, 2019, Paris, France.
- 2018 **Sharp and Diffuse Interface Methods for DNS of Interfacial Transport Processes**, Seminar Lecture during visiting professorship at the Institut de Mécanique des Fluides de Toulouse (IMFT), November 21, 2018, Toulouse, France.
- 2018 **Development of Sharp and Diffuse Interface Methods in OpenFOAM**, Invited Talk at the 2nd German OpenFOAM User meeting, February 21–22, 2018, Braunschweig, Germany.
- 2017 **Direct Numerical Simulation of Bubbly Flow**, Invited Keynote at the 3rd International Conference on Numerical Methods in Multiphase Flows, June 26–29, 2017, Tokyo, Japan.
- 2016 **Numerical Simulation of Bubble Flows**, Symposium FERMaT-SPP1740 "Non-Invasive Measuring Tools and Numerical Methods for the Investigation of Non-Reactive and Reactive Gas-Liquid Flows", June 6–7, 2016, Toulouse, France.
- 2015 **Numerical methods for Direct Numerical Simulations of Transport Processes at Fluidic Interfaces**, Lecture at Summer School on 'Frontiers in Modeling of Multiphase Flows', September 2–4, 2015, Hamburg-Harburg, Germany.
- 2014 **HPC Deployment of OpenFOAM for Direct Numerical Simulations of Two-Phase Interfacial Flows**, Opening Talk at High Performance Computing Hessen (HiPerCH) Workshop, September 22–24, 2014, Darmstadt, Germany.
- 2014 **Numerical Simulation of Interfacial Flows using OpenFOAM – Fundamentals and Capabilities with application to Computational Interfacial Heat and Mass Transfer**, IWR-Colloquium on Computational Methods in Sciences, Interdisciplinary Center for Scientific Computing, May 28, 2014, Heidelberg, Germany.

- 2013 **Numerical Simulation of Interfacial Flows using OpenFOAM – Fundamentals and Capabilities with application to Computational Interfacial Heat and Mass Transfer**, International Topical Team Workshop on Two-Phase Systems for Ground and Space Applications (ITTW2013), September 16–19, 2013, Bremen, Germany.
- 2012 **Numerical Simulation of Interfacial Flows using OpenFOAM – Fundamentals and Capabilities**, Plenary Talk, Jahrestreffen des ProcessNet-Fachausschusses CFD, March 12–14, 2012, Weimar, Germany.
- 2012 **Direct Numerical Simulation of Species Transfer across fluidic Interfaces using OpenFOAM**, Colloquium at the Collaborative Research Centre 578, January 30, 2012, Braunschweig, Germany.

Invited Lectures at Advanced Doctorate Schools

- 2020 International PhD Course on "**Computational Fluid Dynamics with Open-Source Software**" at Politecnico di Milano, Italy
- 2017 **Numerical Description of Wetting Processes**, Short Course on Complex Wetting, Darmstadt, Germany
- 2017 **High Resolution Schemes in OpenFOAM® – Rationale and Design Principles**, Invited seminar lecture delivered at the *Oberwolfach Seminar on 'Compressible and Incompressible Multiphase Flows: Modelling, Analysis, Numerics'*, Oberwolfach Research Institute for Mathematics, Oberwolfach, Germany.
- 2015 **Numerical Methods for Direct Numerical Simulation of Transport Processes at Fluidic Interfaces**, Summer School "Frontiers in Modeling of Multiphase Flows", Hamburg-Harburg, Germany.
- 2013 **Taylor Bubbles and Taylor Flow – A Survey Lecture**, Summer School lecture within the framework of *Priority Programme DFG-SPP 1506 "Transport Processes at Fluidic Interfaces"*, <http://www.dfg-spp1506.de>, Aachen, Germany.

Courses

I designed and taught

- since 2020 **Advanced Methods in Computational Fluid Dynamics** (Weiterführende Methoden der Strömungssimulation) taught jointly with Dr. rer. pol. Markus Lazanowski
- 2016–2019 **Numerical Methods for Direct Numerical Simulations of Two-Phase Flows** (Numerische Methoden zur Direkten Numerischen Simulation von Zweiphasenströmungen), designed as a course supplement to *Advanced Methods in Computational Fluid Dynamics (Weiterführende Methoden der Strömungssimulation)*, taught jointly with Prof. Dr. rer. nat. Michael Schäfer & Dr. rer. pol. Markus Lazanowski
- 2012–2014 **Numerical Modeling of Fluid Interfaces** (Numerische Modellierung fluider Grenzflächen) designed as a course supplement to *Mathematical Modeling of Fluid Interfaces*, taught jointly with Prof. Dr. rer. nat. Dieter Bothe
- 2009–2010 **Computer-Aided Design of Chemical Reactors** (Reaktordesign – Betrieb und Auslegung chemischer Reaktoren, Rechnergestütztes Praktikum)
- 2009–2010 **Computational Fluid Dynamics with OpenFOAM – An Introduction with Tutorials for Chemical and Process Engineers** (Rechnergestütztes Praktikum)

2007–2010 **Heat and Mass Transfer in Chemical Processes** (Wärme- und Stofftransport bei chemischen Prozessen, Zentral-/Rechenübung)

Trainings

- 06/2020 **Multiphysics using OpenFOAM®**, training lecture given at the *15th OpenFOAM Workshop*, Arlington, Virginia, USA, June 22–25, 2020
- 06/2016 **Design and Rationale of High Resolution Schemes in OpenFOAM®**, training lecture given at the *11th OpenFOAM Workshop*, Guimarães, Portugal, June 26–30, 2016
- 08/2012 **Introductory Course to OpenFOAM® for Two-Fluid Modeling**, 3-day training lecture within the framework of BMBF network project *Chemical Processes – Multiscale Modeling of Multiphase Reactors (FKZ: 01RC1102)*, August 15–17, 2012
- 06/2011 **Integrated Development Environment (IDE) Eclipse for OpenFOAM® – Assessing the Performance of bubbleFoam**, Training lecture given jointly with Astrid Mahrla at the *6th OpenFOAM Workshop*, PennState University, USA, June 13–16, 2011

Theses

- 2011 **PhD Thesis**
in fulfilment of the requirements for the degree of doctor of engineering (Dr.-Ing.) to the Faculty of Chemistry of Technische Universität München

Title *Towards the Numerical Simulation of Multi-Scale Two-Phase Flows*

Doctoral Adviser Prof. Dr.-Ing. Olaf Hinrichsen

Manuscript available online

- URL: mediatum.ub.tum.de/?id=1080878
- URN (citable URL): <http://nbn-resolving.de/urn/resolver.pl?urn:nbn:de:bvb:91-diss-20111222-1080878-1-7>

Scientific Highlights

- Unified two-fluid modeling framework for multiscale two-phase flows including flow-regime transitions, entitled 'Hybrid Interface RESolving Two-Fluid Model' (HIRES-TFM)
- Consistent single-field model formulation for interfacial species transfer, entitled 'Continuous Species Transfer' (CST) Model

Defense 2011-12-22

Committee Members

Chair Univ.-Prof. Dr. Karsten Reuter

Examiners

1. Univ.-Prof. Dr.-Ing. Kai-Olaf Hinrichsen, Technische Universität München
2. Univ.-Prof. Dr.-Ing. Harald Klein, Technische Universität München
3. Prof. Dr. sc. Hrvoje Jasak, University of Zagreb / Croatia

2007 **Diploma Thesis**

in fulfilment of the requirements for the diploma degree of engineering (Dipl.-Ing.)

Title *Modeling of a microstructured gas-liquid distributor using CFD* (Modellierung eines mikrostrukturierten Gas-Flüssig-Verteilers mit Hilfe der Computational Fluid Dynamics (CFD)), at BASF SE (Ludwigshafen, Germany)

Supervisors

- Prof. Dr. techn. Johannes Lercher, Technische Universität München
- Dr.-Ing. Axel Schimpf and Dr. rer. nat. Wolfgang Gerlinger, BASF SE

Scientific Highlights

- Numerical modeling of outlet boundary condition preserving overall continuity of the considered gas-liquid distributor
- Adaptive time-stepping procedure according to residual level of a prescribed set for multiple equations

2005 **Term Thesis**

Title *Residence Time Distribution in a Reactive Plate Column: Experimental Investigation and System-Theoretical Modeling* (Verweilzeitmessung in einer reaktiven Bodenkolonnen: Experimentelle Untersuchung und Systemtheoretische Modellierung)

Supervisors

- Prof. Dr.-Ing. Johann Stichlmair, Technische Universität München
- Dr.-Ing. Tobias Dörrhöfer, Technische Universität München

2005 **Term Thesis**

Title *Modeling of Reaction Kinetics of the Homogeneously Catalyzed Methyl Acetate Synthesis* (Modellierung der Reaktionskinetik der homogenkatalysierten Methylacetat-Synthese)

Supervisors

- Prof. Dr.-Ing. Johann Stichlmair, Technische Universität München
- Dr.-Ing. Tobias Dörrhöfer, Technische Universität München

References

Book Chapters

- [1] D. Hillenbrand and H. Marschall. *Reactive Bubbly Flows*, chapter Development and Application of a Direct Numerical Method for Reactive Transport Processes in Bubble Systems, page 490. *Advances in Mathematical Fluid Mechanics*. Springer International Publishing – Birkhäuser Basel, 2021. ISBN 978-3-319-56601-6.
- [2] H. Marschall, C. Falconi, C. Lehrenfeld, R. Abiev, M. Wörner, A. Reusken, and D. Bothe. *Transport Processes at Fluidic Interfaces*, chapter Direct Numerical Simulations of Taylor Bubbles in a Square Mini-Channel: Detailed Shape and Flow Analysis with Experimental Validation, page 689. *Advances in Mathematical Fluid Mechanics*. Springer International Publishing – Birkhäuser Basel, 2017. ISBN 978-3-319-56601-6.
- [3] C. Pesci, K. Dieter-Kissling, H. Marschall, and D. Bothe. *Computational Methods for Complex Liquid-Fluid Interfaces*, chapter Finite Volume/Finite Area Interface-Tracking Method for Two-Phase Flows with Fluid Interfaces Influenced by Surfactant, page 538. *Progress in Colloid and Interface Science*. CRC Press, Taylor & Francis Group, 2015. ISBN 978-1-4987-2208-7.

Published Papers

Peer-Reviewed Journal Contributions

- [4] M. Wörner, N. Samkhaniani, X. Cai, Y. Wu, A. Majumdar, H. Marschall, B. Frohnapfel, and O. Deutschmann. Spreading and rebound dynamics of sub-millimetre urea-water-solution droplets impinging on substrates of varying wettability. *Applied Mathematical Modelling*, 95:53–73, jul 2021.
- [5] D. Gründing, M. Smuda, T. Anritter, M. Fricke, D. Rettenmaier, F. Kummer, P. Stephan, H. Marschall, and D. Bothe. A comparative study of transient capillary rise using direct numerical simulations. *Applied Mathematical Modelling*, 86:142–165, 2020.
- [6] A. Weiner, D. Hillenbrand, H. Marschall, and D. Bothe. Data-driven subgrid-scale modeling for convection-dominated concentration boundary layers. *Chem. Eng. Technol.*, 42(7):1349–1356, 2019.
- [7] Tobias Stark, Thomas Kiedrowski, Holger Marschall, and Andrés Fabián Lasagni. Avoiding starvation in tribocontact through active lubricant transport in laser textured surfaces. *Lubricants*, 7(54):1–18, 2019.
- [8] Daniel Rettenmaier, Daniel Deising, Yun Ouedraogo, Erion Gjonaj, Herbert De Gersem, Dieter Bothe, Cameron Tropea, and Holger Marschall. Load balanced 2D and 3D adaptive mesh refinement in OpenFOAM. *SoftwareX*, 10:100317, 2019.
- [9] M. Niethammer, H. Marschall, and D. Bothe. Robust Direct Numerical Simulation of viscoelastic flows. *Chem. Ing. Tech.*, 91(4):522–528, 2019.

- [10] M. Niethammer, G. Brenn, H. Marschall, and D. Bothe. An extended Volume of Fluid method and its application to single bubbles rising in a viscoelastic liquid. *J. Comput. Phys.*, 387:326–355, 2019.
- [11] F. Jamshidi, H. Heibel, M. Hasert, Xuan Cai, H. Marschall, and M. Wörner. On suitability of phase-field and algebraic Volume-Of-Fluid OpenFOAM solvers for gas-liquid microfluidic applications. *Comput. Phys. Commun.*, 236:72–85, 2019.
- [12] S. Hill, T. Acher, R. Hoffmann, J. Ferstl, D. Deising, H. Marschall, S. Rehfeldt, and H. Klein. Quantification of the separation efficiency of a structured packing by numerical simulation. *Chem. Ing. Tech.*, 91(12):1833–1841, 2019.
- [13] C. Pesci, A. Weiner, H. Marschall, and D. Bothe. Computational analysis of single rising bubbles influenced by soluble surfactant. *J. Fluid Mech.*, 856:709–763, 2018.
- [14] T. Marić, H. Marschall, and D. Bothe. An enhanced un-split face-vertex flux-based VoF method. *J. Comput. Phys.*, 371:967–993, 2018.
- [15] S. Hill, D. Deising, T. Acher, H. Klein, D. Bothe, and H. Marschall. Boundedness-preserving implicit correction of mesh-induced errors for VoF based heat and mass transfer. *J. Comput. Phys.*, 352:285–300, 2018.
- [16] S. Hill, T. Acher, R. Hoffmann, J. Ferstl, D. Deising, H. Marschall, S. Rehfeldt, and H. Klein. Numerical simulation of two-phase flow and interfacial species transfer in structured packings. *Chem. Eng. Trans.*, 69:337–342, 2018.
- [17] V. Fink, X. Cai, A. Stroh, R. Bernard, B. Frohnäpfel, H. Marschall, and M. Wörner. Drop bouncing by micro-grooves. *Int. J. Heat Fluid Flow*, 70:271–278, 2018.
- [18] M. Falcone, D. Bothe, and H. Marschall. 3D direct numerical simulations of reactive mass transfer from deformable single bubbles: An analysis of mass transfer coefficients and reaction selectivities. *Chem. Eng. Sci.*, 177:523–536, 2018.
- [19] D. Deising, D. Bothe, and H. Marschall. Direct Numerical Simulation of mass transfer in bubbly flows. *Computers & Fluids*, 172:524–537, 2018.
- [20] P. Weber, H. Marschall, and D. Bothe. Highly accurate two-phase species transfer based on ALE Interface-Tracking. *Int. J. Heat Mass Transfer*, 104:759–773, 2017.
- [21] M. Niethammer, H. Marschall, C. Kunkelmann, and D. Bothe. A numerical stabilization framework for viscoelastic fluid flow using the finite volume method on general unstructured meshes. *Int. J. Num. Methods Fluids*, 82(2):131–166, 2017.
- [22] M. Falcone and H. Marschall. Explicit Radial-Basis-Function-based Finite-Difference Method for interfacial mass-transfer problems. *Chem. Eng. Technol.*, 40(8):1385–1390, 2017.
- [23] X. Cai, M. Wörner, H. Marschall, and O. Deutschmann. CFD simulation of liquid back suction and gas bubble formation in a circular tube with sudden or gradual expansion. *Emiss. Control Sci. Technol.*, 3(4):289–301, 2017.

- [24] C. J. Falconi, C. Lehrenfeld, H. Marschall, C. Meyer, R. Abiev, D. Bothe, A. Reusken, M. Schlüter, and M. Wörner. Numerical and experimental analysis of local flow phenomena in laminar Taylor flow in a square mini-channel. *Phys. Fluids*, 28(1):012109, 2016.
- [25] D. Deising, H. Marschall, and D. Bothe. A unified single-field model framework for Volume-Of-Fluid simulations of interfacial species transfer applied to bubbly flows. *Chem. Eng. Sci.*, 139:173–195, 2016.
- [26] X. Cai, H. Marschall, M. Wörner, and O. Deutschmann. Numerical study on the wettability dependent interaction of a rising bubble with a periodic open cellular structure. *Catalysis Today*, 273:151–160, 2016.
- [27] T. Marić, H. Marschall, and D. Bothe. lentFoam - A hybrid Level Set / Front Tracking method on unstructured meshes. *Computers & Fluids*, 113:20–31, 2015.
- [28] N. Linder, A. Criscione, I. Roisman, H. Marschall, and C. Tropea. 3D computation of an incipient motion of a sessile drop on a rigid surface with contact angle hysteresis. *Theoretical and Computational Fluid Dynamics*, 29(5-6):373–390, 2015.
- [29] K. Dieter-Kissling, H. Marschall, and D. Bothe. Numerical method for coupled interfacial surfactant transport on dynamic surface meshes of general topology. *Computers & Fluids*, 109:168–184, 2015.
- [30] K. Dieter-Kissling, H. Marschall, and D. Bothe. Direct Numerical Simulation of droplet formation processes under the influence of soluble surfactant mixtures. *Computers & Fluids*, 113:93–105, 2015.
- [31] X. Cai, H. Marschall, M. Wörner, and O. Deutschmann. Numerical simulation of wetting phenomena with a Phase-Field method using OpenFOAM. *Chem. Eng. Technol.*, 38(11):1985–1992, 2015.
- [32] H. Marschall, S. Boden, C. Lehrenfeld, C. J. Falconi Delgado, U. Hampel, A. Reusken, M. Wörner, and D. Bothe. Validation of Interface Capturing and Tracking techniques with different surface tension treatments against a Taylor bubble benchmark problem. *Computers & Fluids*, 102:336–352, 2014.
- [33] K. Dieter-Kissling, M. Karbashi, H. Marschall, A. Javadi, R. Miller, and D. Bothe. On the applicability of drop Profile Analysis Tensiometry at high flow rates using an Interface-Tracking method. *Colloids Surfaces A*, 441:837–845, 2014.
- [34] C. Albert, H. Marschall, and D. Bothe. Direct Numerical Simulation of interfacial mass transfer into falling films. *Int. J. Heat Mass Transfer*, 69:343–357, 2014.
- [35] H. Marschall and O. Hinrichsen. Numerical simulation of multi-scale two-phase flows using a hybrid interface-resolving Two-Fluid Model (HIRES-TFM). *J. Chem. Eng. Jpn.*, 46(8):517–523, 2013.
- [36] X. Chen, H. Marschall, M. Schäfer, and D. Bothe. A comparison of stabilisation approaches for Finite-Volume simulation of viscoelastic fluid flow. *Int. J. Comput. Fluid Dyn.*, 27(6-7):229–250, 2013.

- [37] S. Aland, C. Lehrenfeld, H. Marschall, C. Meyer, and S. Weller. Accuracy of two-phase flow simulations: The Taylor Flow benchmark. *PAMM*, 13(1):595–598, 2013.
- [38] H. Marschall, K. Hinterberger, C. Schöler, F. Habla, and O. Hinrichsen. Numerical simulation of species transfer across fluid interfaces in free-surface flows using OpenFOAM. *Chem. Eng. Sci.*, 78(0):111–127, 2012.
- [39] H. Marschall, R. Mornhinweg, A. Kossmann, S. Oberhauser, K. Langbein, and O. Hinrichsen. Numerical simulation of dispersed gas/liquid flows in bubble columns at high phase fractions using OpenFOAM. Part II – Numerical simulations and results. *Chem. Eng. Technol.*, 34(8):1321–1327, 2011.
- [40] H. Marschall, R. Mornhinweg, A. Kossmann, S. Oberhauser, K. Langbein, and O. Hinrichsen. Numerical simulation of dispersed gas/liquid flows in bubble columns at high phase fractions using OpenFOAM . Part I – Modeling basics. *Chem. Eng. Technol.*, 34(8):1311–1320, 2011.
- [41] F. Habla, H. Marschall, O. Hinrichsen, L. Dietsche, H. Jasak, and J.L. Favero. Numerical simulation of viscoelastic two-phase flows using OpenFOAM. *Chem. Eng. Sci.*, 66(22):5487–5496, 2011.

Conference Contributions (Proceedings Papers)

- [42] S. Hill, T. Acher, R. Hoffmann, J. Ferstl, D. Deising, H. Marschall, S. Rehfeldt, and H. Klein. Numerical simulation of two-Phase flow and interfacial species transfer in structured packings. In *AIChE Spring Meeting*, New Orleans, 2019.
- [43] C. Pesci, H. Marschall, and D. Bothe. Computational Analysis of single rising bubbles influenced by soluble surfactants. In *12th International OpenFOAM Workshop*, Exceter, United Kingdom, July 24–27 2017.
- [44] D. Gründing, D. Bothe, and H. Marschall. Towards wetting processes with Interface-Tracking. In *12th International OpenFOAM Workshop*, Exceter, United Kingdom, July 24–27 2017.
- [45] H. Marschall, D. Deising, K. Dieter-Kissling, T. Marić, P. Weber, and D. Bothe. On numerical methods for the Direct Numerical Simulation of bubbly flow and interfacial mass transfer using OpenFOAM. In *2nd International Symposium on Multiscale Multiphase Process Engineering (MMPE2)*, Hamburg, Germany, September 24–27 2014.
- [46] X. Cai, H. Marschall, M. Wörner, and O. Deutschmann. A Phase Field Method with adaptive mesh refinement for numerical simulation of 3D wetting processes with OpenFOAM. In *2nd International Symposium on Multiscale Multiphase Process Engineering (MMPE2)*, Hamburg, Germany, September 24–27 2014.
- [47] T. Marić, H. Marschall, and D. Bothe. On the Adaptive Mesh Refinement for a 3D geometrical Volume-of-Fluid transport algorithm on unstructured meshes using OpenFOAM. In *Int. Conf. on Multiphase Flow, ICMF*, Jeju, Korea, May 26–31, 2013.

- [48] T. Marić, H. Marschall, and D. Bothe. An object-oriented validation library for two-phase DNS algorithms. In *Euromech Colloquium 555 on Small-Scale Numerical Methods for Multi-Phase Flows*, Bordeaux, France, August 28–30, 2013.
- [49] C. Focke, H. Marschall, and D. Bothe. Investigations of elementary spray processes by means of Direct Numerical Simulations: Interaction of viscous and non-Newtonian droplets. In *Int. Conf. on Multiphase Flow, ICMF*, Jeju, Korea, May 26–31, 2013.
- [50] K. Dieter-Kissling, H. Marschall, and D. Bothe. Direct Numerical Simulation of droplet formation processes under the influence of soluble surfactant mixtures. In *Eighth International Topical Team Workshop – ITTW8 on Two-Phase Systems for Ground and Space Applications*, Bremen, Germany, 2013.
- [51] K. Dieter-Kissling, H. Marschall, and D. Bothe. Direct Numerical Simulation of droplet formation processes under the influence of multiple surfactants. In *Int. Conf. on Multiphase Flow, ICMF*, Jeju, Korea, May 26–31, 2013.
- [52] K. Dieter-Kissling, H. Marschall, and D. Bothe. An object oriented model library for surfactant sorption processes in the Interface-Tracking framework of OpenFOAM. In *Euromech Colloquium 555 on Small-scale numerical methods for multi-phase flows*, Bordeaux, France, August 28–30, 2013.
- [53] S. Aland, C. Lehrenfeld, H. Marschall, C. Meyer, and S. Weller. Accuracy of two-phase flow simulations: The Taylor Flow benchmark. *PAMM*, 13(1):595–598, 2013.
- [54] K. Kissling, H. Marschall, and D. Bothe. Direct Numerical Simulation of Multicomponent Surfactant Transport on Fluid Interfaces. In *6th International Berlin Workshop – IBW6 on Transport Phenomena with Moving Boundaries*, Berlin, Germany, 24th–25th November 2011. VDI Verlag. ISBN 978-3-18-392903-0.

General Audience Papers

- [55] H. Marschall. OpenFOAM – Computational Continuum Modeling of Transport Processes. *hoch³ – the science magazine of TU Darmstadt*, to appear, 2014.

Papers in Preparation / Submitted

Submitted / Under Review in Peer-Reviewed Journals (manuscript on request)

- [56] N. Samkhaniani, A. Stroh, M. Holzinger, H. Marschall, B. Frohnepfel, and M. Wörner. Bouncing drop impingement on heated hydrophobic surfaces. Under Review, 2021.
- [57] A. Dadvand, M. Bagheri, N. Samkhaniani, H. Marschall, and M. Wörner. Advected phase-field method for bounded solution of the Cahn-Hilliard Navier-Stokes equations. Under Review, 2021.

- [58] H. Marschall, X. Cai, L. Cornolti, M. Wörner, and O. Deutschmann. phaseFieldFoam – Conservative Finite Volume discretization of the multiphase Navier-Stokes Allen-Cahn and Cahn-Hilliard equations on general grids with application to dynamic wetting. In Preparation, 2021.
- [59] X. Li, P. Bista, A. Stetten, H. Bonart, S. Hardt, F. Bodziony, H. Marschall, A. Saal, D. Xu, R. Berger, S. Weber, and H.J. Butt. Drop race: How electrostatic forces influence drop motion. In Preparation, 2021.
- [60] F. Bodziony and H. Marschall. Numerical Study of Droplets at Fibers - Spreading and Motion at Single Fiber Strands. In Preparation, 2021.
- [61] F. Bodziony, X. Li, R. Berger, H.J. Butt, and H. Marschall. Droplet Race – Numerical Simulation of Sliding Droplets on Inclined Surfaces. In Preparation, 2021.
- [62] M. Bagheri, B. Stumpf, I. V. Roisman, C. Tropea, M. Wörner, and H. Marschall. Diffuse-interface phase-field methods for simulating highly dynamic two-phase flows. In Preparation, 2021.
- [63] H. Alkafri and H. Marschall. Arbitrary Lagrangian-Eulerian Interface-Tracking – Computational benchmark of increasing complexity on oscillating droplets and bubbles. In Preparation, 2021.

Presentations (Talks and Posters)

International Conferences & Workshops

- [64] H. Marschall, M. Bagheri, N. Samkhaniani, A. Stroh, B. Frohnäpfel, and M. Wörner. Development and Deployment of Diffuse Interface Phase-Field Methods in OpenFOAM. In *15th International OpenFOAM Workshop (OFW15)*, Arlington, VA, USA, June 22–25 2020.
- [65] H. Marschall, X. Cai, M. Wörner, and O. Deutschmann. A phase-field method for numerical simulation of interfacial two-phase flows using OpenFOAM. In *6th GAMM Workshop on Phase-Field Modeling*, Karlsruhe, Germany, February 7–8, 2019.
- [66] M. Niethammer, H. Marschall, C. Kunkelmann, and D. Bothe. Simulation of viscoelastic flows at high Weissenberg Number using a generic numerical stabilization framework. In *6th OpenFOAM User Conference*, Hamburg, Germany, October 23–25, 2018.
- [67] S. Hill, T. Acher, R. Hoffmann, J. Ferstl, D. Deising, H. Marschall, S. Rehfeldt, and H. Klein. Numerical simulation of two-phase flow and interfacial species transfer in structured packings. In *Distillation & Absorption*, Florence, Italy, September 16–19, 2018. (best poster – people’s choice).
- [68] H. Marschall, D. Gründing, J. Waid, D. Bothe, X. Cai, V. Fink, B. Frohnäpfel, and M. Wörner. Wetting Processes by means of Sharp and Diffuse Interface Methods in OpenFOAM. In *Scientific Kick-Off SFB 1194 – Interaction between Transport and Wetting Processes*, Darmstadt, Germany, December 12–13 2016.

- [69] H. Marschall, C. Pesci, P. Weber, and D. Bothe. Finite Volume Interface-Tracking Method for soluble surfactants and interfacial mass transfer. In *SPP1506 International Conference on Transport Processes at Fluidic Interfaces*, Darmstadt, Germany, October 5-7, 2015.
- [70] H. Marschall, C. Pesci, M. Falcone, P. Weber, and D. Bothe. Direct Numerical Simulation of Reactive Mass Transfer and Interfacial Surfactant Transport. In *10th OpenFOAM Workshop (OFW 10)*, Ann Arbor, Michigan, USA, June 29 – July 2, 2015.
- [71] H. Marschall, X. Cai, M. Wörner, and O. Deutschmann. Development of Phase-Field Methods using OpenFOAM – Part I: Method Development and Implementation. In *10th OpenFOAM Workshop (OFW 10)*, Ann Arbor, Michigan, USA, June 29 – July 2, 2015.
- [72] H. Marschall, K. Dieter-Kissling, and D. Bothe. Direct Numerical Simulation of surfactant mixtures – Droplet formation under the Influence of multiple surfactants. In *Int. Conf. on Numerical Methods in Multiphase Flow, ICNMMF-II*, Darmstadt, Germany, June 30 – July 2, 2014.
- [73] H. Marschall and D. Bothe. Interface Tracking Method of OpenFOAM – Interfacial two-phase flow validation against Taylor Bubble Flow. In *Meeting of the International Association of Applied Mathematics (GAMM)*, Novisad, Serbia, March 18–22, 2013.
- [74] H. Marschall. The CoCoons Project – Community-driven Documentation on OpenFOAM Technology. In *8th International OpenFOAM Workshop (OFW8)*, Jeju, Korea, June 11–14, 2013.
- [75] K. Dieter-Kissling, H. Marschall, and D. Bothe. Direct Numerical Simulation of Droplet Formation under the Influence of Multiple Surfactants. In *Int. Conf. on Multiphase Flow, ICMF*, Jeju, Korea, May 26–31, 2013.
- [76] K. Dieter-Kissling, H. Marschall, and D. Bothe. Block-Coupled Direct Numerical Simulation of Multicomponent Surfactant Transport on Fluidic Interfaces. In *Euromech Colloquium 555 on Small-Scale Numerical Methods for Multi-Phase Flows*, Bordeaux, France, August 28–30, 2013.
- [77] K. Kissling, H. Marschall, and D. Bothe. Direct Numerical Simulation of Multicomponent Surfactant Transport on Fluidic Interfaces. In *Meeting of the International Association of Applied Mathematics (GAMM)*, Darmstadt, Germany, March 26–30, 2012.
- [78] K. Kissling, H. Marschall, and D. Bothe. Block-Coupled Direct Numerical Simulation of Multicomponent Surfactant Transport on Fluidic Interfaces. In *1st International Conference on Numerical Methods in Multiphase Flows (ICNMMF-I)*, Penn State University, Pennsylvania, United States of America, June 12–14, 2012.
- [79] O. Hinrichsen H. Marschall and D. Bothe. Towards the Numerical Simulation of Multi-Scale Two-Phase Flows – The Hybrid Interface-Resolving Two-Fluid Model (HIRES-TFM). In *7th International OpenFOAM Workshop*, Darmstadt, Germany, June 25–28, 2012.

- [80] H. Marschall, C. Schüler, K. Hinterberger, and O. Hinrichsen. Numerical Simulation of Species Transfer at Gas-Liquid Interfaces using OpenFOAM –Concept of the Continuous-Species-Transfer (CST) Method. In *8th International Conference on CFD in Oil & Gas, Metallurgical and Process Industries (CFD 2011)*, Trondheim, Norway, June 21,-23, 2011.
- [81] H. Marschall and O. Hinrichsen. Numerical Simulation of Multiscale Two-Phase Flows using a Hybrid Interface-Resolving Two-Fluid Model (HIRES-TFM). In *8th European Congress of Chemical Engineering (ECCE 8)*, Berlin, Germany, September 25–29, 2011.
- [82] H. Marschall and O. Hinrichsen. Numerical Simulation of Multiscale Two-Phase Flows using a Hybrid Interface-Resolving Two-Fluid Model (HIRES-TFM). In *1st International Symposium on Multiscale Multiphase Process Engineering (MMPE 1)*, Kanazawa, Japan, October 4–7, 2011.
- [83] H. Marschall, C. Schüler, K. Hinterberger, and O. Hinrichsen. Numerical Simulation of Species Transfer at Gas-Liquid Interfaces using OpenFOAM – Concept of the Continuous-Species-Transfer (CST) Method. In *5th OpenFOAM Workshop (OFW 5)*, Gothenburg, Sweden, June 21-24, 2010.
- [84] H. Marschall, C. Schüler, and O. Hinrichsen. Numerical Simulation of Species Transfer at Gas-Liquid Interfaces using CFD – Concept of the Continuous-Species-Transfer (CST) Method. In *9th International Congress of Chemical and Process Engineering (CHISA 2010) at the 7th European Congress of Chemical Engineering (ECCE 7)*, Prague, Czech Republic, August 28 – September 1, 2010.
- [85] H. Marschall, W. Polifke, and O. Hinrichsen. Numerical Simulation of Large-Scale Bubble Column Reactors using a Hybrid Multiphase-CFD Approach (HIRES-TFM). In *6th International Symposium on Multifunctional Reactors (ISMR-6) at the 8th World Congress of Chemical Engineering (WCCE 8)*, Montreal, Canada, August 23–27, 2009.
- [86] H. Marschall and O. Hinrichsen. Numerical simulation of free-surface-flows using openfoam. In *1st Workshop on Single and Two-Phase Flow Simulations with OpenFOAM: Modelling and Numerical Issues*, Darmstadt, Germany, April 7–8, 2009.
- [87] H. Marschall, W. Polifke, and O. Hinrichsen. Numerical simulations of gas-liquid-reactors with bubbly flows using a hybrid multiphase-CFD approach (HIRES-TFM). In *20th International Symposium on Chemical Reaction Engineering – ISCRE 20*, Kyoto, Japan, September 7–10, 2008.
- [88] H. Marschall, W. Polifke, and O. Hinrichsen. Numerical simulation of gas-liquid reactors with bubbly flows using a hybrid multiphase-CFD approach in OpenFOAM (HIRES-TFM). In *Computational Fluid Dynamics in Chemical Reaction Engineering V – CFDCRE 5*, Whistler, Canada, June 15–20, 2008.

- [89] H. Marschall, K. Dieter-Kissling, C. Pesci, P. Weber, and D. Bothe. Numerical Modeling of Transport Processes at Fluidic Interfaces. In *Jahrestreffen des ProcessNet-Fachausschusses CFD*, Lüneburg, Germany, March 19–20, 2015.
- [90] X. Cai, H. Marschall, M. Wörner, and O. Deutschmann. Development of Phase-Field Methods for Direct Numerical Simulation of Wetting Processes using OpenFOAM. In *Jahrestreffen des ProcessNet-Fachausschusses CFD*, Lüneburg, Germany, March 19–20, 2015.
- [91] H. Marschall, D. Deising, and D. Bothe. Modeling and Numerical Simulation of Species Transfer in Bubbly Flows – DNS of Hydrodynamics and Species Transfer. In *BMBF network project meeting 'Chemical Processes – Multiscale Modeling of Multiphase Reactors'*, Marl, Germany, May 18–19, 2013.
- [92] H. Marschall, D. Deising, and D. Bothe. Modeling and Numerical Simulation of Species Transfer in Bubbly Flows – Concept of the Continuous Species Transfer (CST) Method. In *Jahrestreffen des ProcessNet-Fachausschusses CFD*, Weimar, Germany, March 4–6, 2013.
- [93] K. Dieter-Kissling, H. Marschall, and D. Bothe. Experimental and Computational Analysis of Fluidic Interfaces influenced by Soluble Surfactants. In *DFG SPP 1506 Kick-off Meeting – Transport Processes at Fluidic Interfaces*, Aachen, Germany, July 15, 2013.
- [94] T. Marić, H. Marschall, and D. Bothe. voFoam - 3D geometrical Volume-of-Fluid method on unstructured meshes using OpenFOAM. In *Workshop on Numerical Methods for Two-phase Flow*, Stuttgart, Germany, November 28–30, 2012.
- [95] K. Kissling, H. Marschall, and D. Bothe. Block-Coupled Direct Numerical Simulation of Multicomponent Surfactant Transport on Fluidic Interfaces. In *PhD Workshop within the framework of DFG SPP 1506 – Transport Processes at Fluidic Interfaces*, Dresden, Germany, July 1–3, 2012.
- [96] H. Marschall and D. Bothe. Rigorous Modeling of Interfacial Transport Processes in Bubble Columns – Sharp Interface Modeling and VOF-Simulation. In *Meeting of Campus Blasensäulen on the fringes of the 8th European Congress of Chemical Engineering (ECCE 8)*, Berlin, Germany, September 26, 2011.
- [97] H. Marschall, C. Schüler, and O. Hinrichsen. Numerische Simulation des Stofftransports über fluide Phasengrenzflächen mittels CFD – Konzept der Continuous-Species-Transfer (CST) Methode. In *Jahrestreffen des ProcessNet-Fachausschusses CFD*, Hamburg, Germany, March 8–10, 2010.
- [98] H. Marschall, J. Hable, and O. Hinrichsen. Numerische Reaktormodellierung mittels anisotropem Dispersionsmodell in OpenFOAM. In *Jahrestreffen Reaktionstechnik*, Würzburg, Germany, May 10–12, 2010.

- [99] H. Marschall, W. Polifke, and O. Hinrichsen. Numerische Simulation von Blasen-säulenreaktoren mittels hybridem CFD-Modell in OpenFOAM (HIRES-TFM). In *Jahrestreffen Reaktionstechnik*, Würzburg, Germany, June 8–10, 2009.
- [100] H. Marschall, W. Polifke, and O. Hinrichsen. Numerische Simulation disperser Gas-Flüssig-Strömungen in Blasen-säulen bei hohen Gasleerrohrgeschwindigkeiten mit OpenFOAM. In *Jahrestreffen des ProcessNet-Fachausschusses CFD*, Fulda, Germany, March 30–31, 2009.
- [101] H. Marschall, C. Labonte, W. Polifke, and O. Hinrichsen. Numerische Simulation thermo-fluiddynamischer Phänomene an Phasengrenzflächen in Gas-Flüssig-Strömungen mit OpenFOAM. In *Jahrestreffen des ProcessNet-Fachausschusses CFD*, Fulda, Germany, March 30–31, 2009.
- [102] H. Marschall, W. Polifke, and O. Hinrichsen. Numerical Simulations of Gas-Liquid-Reactors with Bubbly Flows using a Hybrid Multiphase-CFD Approach in OpenFOAM (HIRES-TFM). In *ProcessNet-Jahrestagung*, Karlsruhe, Germany, October 7–9, 2008.
- [103] H. Marschall, W. Polifke, and O. Hinrichsen. Numerical Simulations of Gas-Liquid-Reactors with Bubbly Flows using a Hybrid Multiphase-CFD Approach (HIRES-TFM). In *Jahrestreffen Reaktionstechnik*, Würzburg, Germany, May 18–20, 2008.
- [104] H. Marschall, W. Polifke, and O. Hinrichsen. Numerical Simulation of Gas-Liquid-Reactors with Bubbly Flows using a Hybrid Multiphase-CFD Approach (HIRES-TFM). In *Jahrestreffen des ProcessNet-Fachausschusses CFD*, Würzburg, Germany, February 18–20, 2008.

Survey Lectures

- [105] H. Marschall. Numerical Modeling of Moving Contact Lines – A Survey covering Volume-Tracking, Interface-Tracking and Front-Tracking contact line approaches. In *Graduate School of Computational Engineering – Research Focus 6 'Multiphase Flows'*, Darmstadt, Germany, July 17, 2015.
- [106] H. Marschall. Dimensionless Groups in Process and Reaction Engineering. In *PhD Workshop within the framework of DFG SPP 1740 – Transport Processes and Chemical Reaction in Gas-Liquid Systems*, Aachen, Germany, November 23–24, 2015.
- [107] H. Marschall. Taylor Bubbles and Taylor Flow – A Survey Lecture. In *PhD Workshop within the framework of DFG SPP 1506 – Transport Processes at Fluidic Interfaces*, Aachen, Germany, July 17, 2013.
- [108] H. Marschall. Finite Volume Method and High Resolution Schemes on Arbitrary Unstructured Meshes. In *Graduate School of Computational Engineering – Research Focus 6 'Multiphase Flows'*, Darmstadt, Germany, July 9, 2013.

- [109] H. Marschall, D. Deising, D. Rettenmaier, M. Niethammer, T. Marić, and D. Bothe. Some OpenFOAM Developments at Technische Universität Darmstadt. In *ESI OpenCFD Webinar*, April 18, 2018. (guest talk).
- [110] H. Marschall, M. Niethammer, T. Marić, K. Dieter-Kissling, and D. Bothe. Complex Fluids and Coupled Physics – A Sketch on New Techniques and Methods using OpenFOAM. In *OpenFOAM User Group Meeting (Southern Germany)*, Department of Mechanical and Process Engineering, Technische Universität Kaiserslautern, Darmstadt, Germany, January 12, 2014.
- [111] H. Marschall, J. Saal, and D. Bothe. Introduction to the Finite Volume Method on Arbitrary Unstructured Meshes & Methods, Codes and Scientific Foci at Mathematical Modelling and Analysis (MMA). In *Research Seminar Series, Center of Smart Interfaces*, Technische Universität Darmstadt, Darmstadt, Germany, May 23, 2013.
- [112] H. Marschall and O. Hinrichsen. Numerical Simulation of Bubble Column Reactors using Computational Fluid Dynamics (German: Numerische Simulation von Blasensäulen-Reaktoren mittels Computational Fluid Dynamics). In *Open Day (German: Tag der Offenen Tür) of the Department of Chemistry*, Technische Universität München, Garching, Germany, October 18, 2008.
- [113] H. Marschall. From Molecular Thinking to an Engineering Approach – Computational Multi-Fluid Dynamics, C(M)FD. In *Research Colloquium at the Institute for Technical Chemistry*, Technische Universität München, Garching, Germany, April 30, 2008.
- [114] H. Marschall, W. Polifke, and O. Hinrichsen. Numerical Simulation of Bubble Column Reactors using Computational Fluid Dynamics (German: Numerische Simulation von Blasensäulen-Reaktoren mittels Computational Fluid Dynamics). In *The Long Night of the Sciences (German: Lange Nacht der Wissenschaften) on the Garching Campus*, Technische Universität München, Garching, Germany, October 13, 2007.

Community Activities

since 2018 **Assigned Member** within the official OpenFOAM Governing Structure by ESI

- **Chair** of the Technical Committee on Multiphase Flows.
- **Representative** of Technische Universität Darmstadt in the OpenFOAM Steering Committee
- **Website:** www.openfoam.com/governance

since 2013 **Social Media activity** on LinkedIn (platform for professional networking)

- **Followers:** 4000+
- **Content:** focus on technical and scientific details in numerical fluid simulations
- **Website:** www.linkedin.com/in/holger-marschall-62175683/

Darmstadt, May 17, 2021



Dr.-Ing. H. Marschall