



Holger Marschall

Curriculum Vitæ

Personal Details

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

Professional Details

Position Head of Junior Research Group "Advanced Two-Phase and Interfacial Flow Simulations using OpenFOAM" & Postdoctoral Research Associate (Habilitation)
Address Technische Universität Darmstadt
Center of Smart Interfaces,
Mathematical Modeling and Analysis
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Education

Academic Education

since 2011 Habilitation

Post-Doctoral Lecturing Qualification

since 01/2011

Postdoctoral Research Associate (Habilitation), *Technische Universität Darmstadt, Center of Smart Interfaces, Mathematical Modeling and Analysis (Prof. Dr. rer. nat. Dieter Bothe).*

*Dr.-Ing. Holger Marschall – Research Group Leader
Mathematical Modeling and Analysis – Center of Smart Interfaces
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2007 – 2011 **Doctorate**

Doctoral Research Qualification

12/2011

Dr.-Ing., *Technische Universität München*, Munich, mark 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, mark 1.5.

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

04–10/2006

Diploma Thesis, *BASF SE (Ludwigshafen)*, mark 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)*, mark 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.

Work Experience

Academic Career

since 01/2011

Research Group Leader & Postdoctoral Research Associate (Habilitation), *Technische Universität Darmstadt*, Center of Smart Interfaces, 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).

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Research

Research Foci & Scientific Interests

My research is focused in **Computational Fluid Dynamics (CFD) around the Open Source C++ Library OpenFOAM®**. In particular, my research interest includes the **transport processes & physicochemical phenomena** in **two- and multiphase systems**, multi-scale modeling of these systems and corresponding **numerical methods** to cope with associated challenges.

Precisely, my research is substantially *motivated by* the fields of

- *Sharp Interface Continuum Thermo-Mechanical & Diffuse Interface Models*
- *Transport Processes at Fluid Interfaces*
- *Two-Phase Flows of non-Newtonian Fluids*

In my research work advanced simulation techniques are devised or newly developed in order to approach open questions in above fields.

Research Collaborations & Cooperations

Research Topics & Methods

Methods

- *Hybrid Method* for Two-Phase Reaction-Advection-Diffusion Equations at High Schmidt Numbers
- Unsplit Geometrical **Volume-of-Fluid Interface Capturing Methods** on Unstructured Meshes of General Topology
- Bounded Higher-Order Schemes (*High-Resolution Schemes*) for **Algebraic Volume-of-Fluid Interface Capturing Methods**
- **Immersed-Boundary Front Tracking Methods**
- **Phase-Field Interface Capturing Methods** (diffuse interface models)
- **Arbitrary Lagrangian-Eulerian Interface Tracking Methods**

Current Topics

- *Interfacial Mass Transfer* across Fluid Interfaces
- *Multicomponent Surfactant Transport* on Fluidic Interfaces
- *Viscoelastic Two-Phase Flows* at High Weissenberg Numbers

Research Partners

Dr.-Ing. Thomas Acher Department Equipment Process Design & Computational Mechanics (ENCP2), Linde AG, Munich, Germany

Dr. Sebastian Aland Institute of Scientific Computing, Dresden University of Technology, Dresden, Germany

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Prof. Dr. Dieter Bothe Mathematical Modeling and Analysis, Center of Smart Interfaces, Technische Universität Darmstadt, Germany

Prof. Dr. Christian Bischof Scientific Computing, Technische Universität Darmstadt, Germany

Dr. Laura Dietsche Core R&D, Dow Chemical, Midland, MI, United States of America

Dr. Harald Ehrentraut Computer Aided Engineering, Freudenberg New Technologies SE & Co. KG, Weinheim, Germany

Prof. Dr. Uwe Hampel AREVA Endowed Chair of Imaging Techniques in Energy and Process Engineering, Dresden University of Technology, Dresden, Germany

Prof. Dr. Olaf Hinrichsen Chair of Chemical Engineering, Technische Universität München, Munich, Germany

Prof. Dr. Hrvoje Jasak Wikki Ltd., London, United Kingdom & Faculty of Mechanical Engineering and Naval Architecture, University of Zagreb, Zagreb, Croatia

Dr. Christian Kunkelmann GCP/RC – BASF SE, Ludwigshafen, Germany

Dr. Reinhard Miller Max Planck Institute of Colloids and Interfaces, Golm, Germany

Prof. Wolfgang Polifke, PhD Chair for Thermodynamics, Technische Universität München, Munich, Germany

Prof. Dr. Arnold Reusken Chair for Numerical Mathematics, IGPM, RWTH Aachen, Aachen, Germany

Dr. Georg Skillas Computer Aided Process Engineering & Automation, Evonik Industries AG, Hanau-Wolfgang, Germany

Prof. Dr. Michael Schlüter Institute of Multiphase Flows (IMS), Hamburg University of Technology (TUHH), Hamburg-Harburg, Germany

Dr. Željko Tuković Faculty of Mechanical Engineering and Naval Architecture, University of Zagreb, Zagreb, Croatia

Dr. Martin Wörner Institute of Catalysis Research and Technology (IKFT), Karlsruher Institut für Technologie (KIT), Karlsruhe, Germany

Scientific Roles in Research Network Programmes & Institutions

- **Collaborative Research Centre DFG-SFB 1194** *Mutual Influence of Wetting and Transport Processes*; Principal Investigator², Supervisor.
- **Priority Programme DFG-SPP 1740** *Influence of Local Transport Processes on Chemical Reactions in Bubbly Flows*, www.dfg-spp1740.de; Principal Investigator², Supervisor.
- **Priority Programme DFG-SPP 1506** *Transport Processes at Fluidic Interfaces*, www.dfg-spp1506.de; Participating Investigator (with specified effort), Co-supervisor.

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- **Cluster of Excellence EXC-259** *Smart Interfaces Understanding and Designing Fluid Boundaries*, www.csi.tu-darmstadt.de; Participating Investigator¹.
- **BMBF network project (FKZ: 01RC1102)** *Chemical Processes – Multiscale Modeling of Multiphase Reactors*, www.chemieundco2.de; Participating Investigator (without specified effort), Co-supervisor.

Awards and Recognition

- 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)
- 2000 **A-level Certificate with Distinction** (Abitur "mit Auszeichnung", Gymnasium Spaichingen); Advanced Placement Level courses in **Mathematics and Physics**.

Memberships in Scientific Committees & Professional Bodies

Membership in Scientific Committees

- since 2015 Assigned Member of the DECHEMA ProcessNet Committee Computational Fluid Dynamics
- 2014 Member of the scientific committee of the 2nd International Symposium on Multiscale Multiphase Process Engineering (MMPE 2), Hamburg, Germany
- since 2010 Member of the OpenFOAM Workshop Committee, active in organizing the world's largest community-driven OpenFOAM event

Organization of Scientific Events

- 2014 2nd International Conference on Numerical Methods in Multiphase Flow (ICNMMF-II), Darmstadt, 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)

¹**Participating Investigator, with specified effort:** investigator who contributes in a substantive way to the scientific development or execution of the research project and who has effort specified and quantified in the external proposal.

Participating Investigator, without specified effort: investigator who is involved in the scientific development and execution of the project, but who has no specified or quantified effort in the external proposal.

²**Principal Investigator:** lead scientist responsible for research project, which includes the intellectual conduct of the project, fiscal accountability, administrative aspects, and adherence to relevant policies and regulations.

- 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 the following journals in my field:

- *International Journal of Computational Physics*,
- *International Journal for Numerical Methods in Fluids*,
- *International Journal of Computational Fluid Dynamics*,
- *Computer Physics Communications*,
- *Chemical Engineering Science*,
- *International Journal of Heat and Mass Transfer*,
- *International Journal of Multiphase Flow*,
- *Applied Mathematical Modelling*,
- *SoftwareX*,
- *Microfluidics and Nanofluidics*,
- *Chemical Engineering Technology & Chemie Ingenieur Technik*,
- *Journal of Colloid and Interface Science*,
- *Oil & Gas Science and Technology*.

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

Professional Expertise

Core Competencies & Qualifications

My interest during my studies of **Chemical Engineering** has been with *reactor design and reaction engineering*, in particular with topics related to **Computational Engineering**. Therefore, I decided to focus on *computational techniques and numerical simulation methods* attending specific, mostly **extra-curricular courses and lectures**, e.g.

- **Numerical Simulation of Fluid Flow** (Numerische Simulation realer Strömungen),
- **Simulation of Thermo-Fluid Dynamical Processes** (Simulation Thermofluid-dynamischer Prozesse),
- **Two-Phase Flow Simulation in Process Engineering** (Simulation der Zweiphasenströmung in der Prozesstechnik),
- **Reactor Simulation** (Reaktortechnische Simulation).

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During my academic career, especially as **Research Group Leader & Postdoctoral Research Associate (Habilitation)**, I have deepened my knowledge and skills further, in particular focusing on

- **Two-Phase Flow Simulation Methods** (Volume-Of-Fluid Interface-Capturing, Arbitrary-Lagrangian-Eulerian Interface-Tracking, Phase-Field Interface-Capturing, Immersed-Boundary Front-Tracking)
- **Continuum Modeling** including **Transport Processes at Fluid Interfaces** based on Sharp and Diffuse Interface Models
- **Object-oriented and Generic Programming** within the **OpenFOAM C++ framework** for Computational Fluid Dynamics

As head of a junior research group of 10 PhD, Master and Bachelor students with 5 years experience, I gained strong expertise in initiating, coordinating and contributing to several research projects.

Expert Skills and Specialist Knowledge

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 System, Waterfall.
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 (9 years at school)
Chinese	Basics (1 year university course)
Courses	English for Technical Purposes, International Business English

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- Assessment Self-assessment of language proficiency according to the
- 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, Center of Smart 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)
 - Interface Tracking with the capability of large deformations and topological changes (automatic local dynamic remeshing)
 - Consistent numerical modeling of moving contact lines and dynamic contact angles for dynamic wetting processes
 - Detailed insights into the mutual local interplay between insoluble and soluble surfactant transport and two-phase hydrodynamics in the vicinity of the contact line
- **Development and Application of a Direct Numerical Method for Reactive Transport Processes in Bubble Systems** (M.Sc. Manuel Falcone)
 - Hybrid Lagrangian/Eulerian method to cope with High Schmidt Number Problem (HSNP), a multi-scale problem due to thin interfacial concentration boundary layers in reactive mass transfer problems
 - Conservative, geometrical Volume-of-Fluid (VOF) method with unsplit advection (cf. M.Sc. Tomislav Marić)
 - Self-organizing adaptive resolution Lagrangian Particle Method (SOAR LPM)
 - Hermite Radial Basis Function based Finite-Difference Lagrangian Particle Method (HRBF-FDM LPM)

Co-supervisor and Participating Investigator

Technische Universität Darmstadt, Center of Smart 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)
 - Interface Tracking with the capability of large deformations and topological changes (automatic local dynamic remeshing)
 - Block-coupled solution of multi-component transport equations on the interface
 - Multi-region coupling between interfacial and bulk solution domains using both the Finite Volume Method and the Finite Area Method

- **Advanced Volume-of-Fluid Methods on Unstructured Meshes in OpenFOAM with Applications to Fluid Interfaces** (M.Sc. Tomislav Marić)
 - Sharp interface representation by geometrical reconstruction on arbitrary unstructured meshes
 - Unsplit advection using advanced algorithms from computational geometry

- **Modeling and Numerical Simulation of Multi-component Two-Phase Fluid Systems with Ionic Species** (M.Sc. Paul Weber)
 - Implementation of multicomponent transport into the Interface Tracking framework (incl. non-ionic and ionic cross effects)
 - Domain-domain Coupling: Analysis of discrete explicit Dirichlet-Neumann coupling for interfacial species transfer (passive scalar)
 - Equation-equation Coupling: Block-coupled solution of multi-component transport equations within the bulk phases

- **Interfacial Mass Transfer for implicit algebraic Volume-of-Fluid methods** (Dipl.-Ing. Daniel Deising)
 - Finite Volume Method consistent single-field formulation achieved by conditional volume-averaging – Continuous-Species-Transfer (CST) method
 - Discretization, algorithm and solution strategies for single and multiple bubble systems (bubble groups)

- **Numerical Simulation of Viscoelastic Two-Phase Flows** (M.Sc. Matthias Niethammer)
 - Finite Volume Method consistent single-field formulation achieved by conditional volume-averaging
 - State-of-the-art High Weissenberg Number Problem (HWNP) stabilization techniques using conformation tensor representation
 - Discretization, algorithm and solution strategies for single and two-phase flow settings

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Co-supervisor and Participating Investigator

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)
 - Finite Volume Method consistent single-field formulation achieved by conditional volume-averaging – Continuous-Species-Transfer (CST) method
 - Boundedness-Preserving Implicit Correction of Mesh-induced Errors of VOF-based scalar transport

Supervision of M.Sc. & Undergraduate Student Projects

Co-supervisor – Numerical Studies

Technische Universität Darmstadt, Center of Smart 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)

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- **Numerical Simulation of Free-Surface Flows in OpenFOAM with Focus on Validation and Verification** (Thomas Bartsch)
- **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 Polydispersed Multiphase Flows in Bubble Columns using Modern Pressure Sensors** (German: Entwicklung und Implementierung eines Messsystems zur Erfassung transienter, polydisperser Mehrphasenströmungen in Blasensäulen mittels moderner Drucksensorik-Verfahren) (Anna Reif)

Invited Talks & Lectures

- 2015 **Numerical methods for Direct Numerical Simulations of Transport Processes at Fluidic Interfaces**, Lecture at Summer School on 'Frontiers in Modeling of Multiphase Flows', 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, Darmstadt, Germany.

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- 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, 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), Bremen, Germany.
- 2012 **Numerical Simulation of Interfacial Flows using OpenFOAM – Fundamentals and Capabilities**, Plenary Talk, Jahrestreffen des ProcessNet-Fachausschusses CFD, Weimar, Germany.
- 2012 **Direct Numerical Simulation of Species Transfer across fluidic Interfaces using OpenFOAM**, Colloquium at the Collaborative Research Centre 578, Braunschweig, Germany.

Invited Seminars at Advanced Doctorate Schools

- 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.
- 2015 **Numerical Methods for Direct Numerical Simulation of Transport Processes at Fluidic Interfaces**, Summer School "Frontiers in Modeling of Multiphase Flows", Hamburg-Harburg, Germany.

Seminar and Tutorial Lectures

I designed and taught

- since 2016 **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)

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Courses and Trainings

- 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.)

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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 Bodenkolonne: 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

Academic Degree Theses

- [1] H. Marschall. *Towards the Numerical Simulation of Multi-Scale Two-Phase Flows*. PhD thesis, Technische Universität München, 2011.
- [2] H. Marschall. *Modeling of a microstructured gas-liquid distributor using CFD*. Diploma Thesis, Technische Universität München / BASF SE, 2007.

Monographs, Books and Book Chapters

- [3] C. Pesci, K. Dieter-Kissling, H. Marschall, and D. Bothe. *Computational Methods for Complex Liquid-Fluid Interfaces*, chapter Finite Volume/Finite Area Interface-

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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, December 2015. ISBN 978-1-4987-2208-7.

Papers

Peer-Reviewed Journal Contributions

- [4] 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.
- [5] 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.
- [6] 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.
- [7] T. Marić, H. Marschall, and D. Bothe. lentFoam - A hybrid Level Set / Front Tracking method on unstructured meshes. *Computers & Fluids*, 113:20–31, 2015.
- [8] 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.
- [9] 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.
- [10] 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.
- [11] 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.
- [12] 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.
- [13] 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.
- [14] 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.

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- [15] 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.
- [16] 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.
- [17] 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.
- [18] H. Marschall, K. Hinterberger, C. Schüller, 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.
- [19] 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.
- [20] 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.
- [21] 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)

- [22] 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.
- [23] 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.
- [24] 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.
- [25] 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.

- [26] 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.
- [27] 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.
- [28] 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.
- [29] 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.
- [30] 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.
- [31] K. Kissling, H. Marschall, and D. Bothe. Direct Numerical Simulation of Multi-component 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

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

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

- [33] P. Weber, H. Marschall, and D. Bothe. Highly accurate two-phase species transfer based on ALE Interface-Tracking. Submitted, December 2015. 1–51.
- [34] T. Marić, H. Marschall, and D. Bothe. voFoam – A geometrical Volume-of-Fluid algorithm on arbitrary unstructured meshes with local dynamic Adaptive Mesh Refinement using OpenFOAM. Under Review, arXiv preprint (arXiv:1305.3417) available online (<http://arxiv.org/abs/1305.3417>), May 2013. 1–29.

In Preparation for Submission to Peer-Reviewed Journals

- [35] 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. In Preparation, 2014.
- [36] H. Marschall, X. Cai, M. Wörner, and O. Deutschmann. phaseFieldFoam – Conservative Finite Volume discretization of the two-phase Navier-Stokes Allen-Cahn and

Cahn-Hilliard equations on general grids with application to dynamic wetting. In Preparation, 2014.

Presentations (Talks and Posters)

Invited Talks & Lectures

- [37] H. Marschall, M. Falcone, P. Weber, C. Pesci, and D. Bothe. Numerical methods for Direct Numerical Simulations of Transport Processes at Fluidic Interfaces. In *Summer School on 'Frontiers in Modeling of Multiphase Flows'*, Hamburg-Harburg, Germany, September 02–04, 2015.
- [38] H. Marschall, D. Deising, T. Marić, M. Niethammer, S. Batzdorf, and D. Bothe. HPC deployment of OpenFOAM for Direct Numerical Simulations of two-phase interfacial flows. In *High Performance Computing Hessen (HiPerCH) Workshop*, Darmstadt, Germany, September 22–24, 2014.
- [39] H. Marschall and D. Bothe. Numerical Simulation of Interfacial Flows using OpenFOAM – Fundamentals and Capabilities with application to Computational Interfacial Heat and Mass Transfer. In *IWR-Colloquium on Computational Methods in Sciences*, Heidelberg, Germany, May 28, 2014. Interdisciplinary Center for Scientific Computing.
- [40] H. Marschall and D. Bothe. Numerical Simulation of Interfacial Flows using OpenFOAM – Fundamentals and Capabilities with application to Computational Interfacial Heat and Mass Transfer. In *International Topical Team Workshop on Two-Phase Systems for Ground and Space Applications (ITTW2013)*, Bremen, Germany, September 16–19, 2013.
- [41] H. Marschall, C. Schüler, K. Hinterberger, and O. Hinrichsen. Direct Numerical Simulation of Species Transfer across fluidic Interfaces using OpenFOAM. In *113th Colloquium at the Collaborative Research Centre 578: From Gene to product – Development of biotechnical processes by integrating genetic and engineering methods*, Braunschweig, Germany, January 30, 2012.
- [42] H. Marschall, K. Kissling, T. Marić, and D. Bothe. Numerical Simulation of Interfacial Flows using OpenFOAM – Fundamentals and Capabilities. In *Jahrestreffen des ProcessNet-Fachausschusses CFD*, Weimar, Germany, March 12–14, 2012.

International Conferences

- [43] H. Marschall, C. Pesci, P. Weber, and D. Bothe. Finite Volume Interface-Tracking Method for soluble surfactants and interfacial mass transfer. In *SPP 1506 International Conference on Transport Processes at Fluidic Interfaces*, Darmstadt, Germany, October 5-7 2015.
- [44] 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.

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- [45] 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.
- [46] 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.
- [47] 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.
- [48] 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.
- [49] 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.
- [50] 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.
- [51] 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.
- [52] 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.
- [53] 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.
- [54] 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.

- [55] 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.

International Workshops

- [56] 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.
- [57] 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.
- [58] H. Marschall. The CoCoons Project – Community-driven Documentation on OpenFOAM Technology. In *8th International OpenFOAM Workshop (OFW8)*, Jeju, Korea, June 11–14, 2013.
- [59] 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.
- [60] 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.
- [61] 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.
- [62] 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.

National Conferences and Workshops

- [63] 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.
- [64] 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.

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- [65] 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.
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- [67] 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.
- [68] 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.
- [69] 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.
- [70] 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.
- [71] 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.
- [72] H. Marschall, J. Hable, and O. Hinrichsen. Numerische Reaktormodellierung mittels anisotropem Dispersionsmodell in OpenFOAM. In *Jahrestreffen Reaktionstechnik*, Würzburg, Germany, May 10–12, 2010.
- [73] H. Marschall, W. Polifke, and O. Hinrichsen. Numerische Simulation von Blasensäulenreaktoren mittels hybridem CFD-Modell in OpenFOAM (HIRES-TFM). In *Jahrestreffen Reaktionstechnik*, Würzburg, Germany, June 8–10, 2009.
- [74] H. Marschall, W. Polifke, and O. Hinrichsen. Numerische Simulation disperser Gas-Flüssig-Strömungen in Blasensäulen bei hohen Gasleerrohrgeschwindigkeiten mit OpenFOAM. In *Jahrestreffen des ProcessNet-Fachausschusses CFD*, Fulda, Germany, March 30–31, 2009.
- [75] H. Marschall, C. Labonte, W. Polifke, and O. Hinrichsen. Numerische Simulation thermo-fluidodynamischer Phänomene an Phasengrenzflächen in Gas-Flüssig-Strömungen mit OpenFOAM. In *Jahrestreffen des ProcessNet-Fachausschusses CFD*, Fulda, Germany, March 30–31, 2009.

- [76] 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.
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Seminars and Courses

- [79] 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.
- [80] 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.
- [81] 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.
- [82] 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.

Talks for General Audiences

- [83] 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.
- [84] 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.
- [85] 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.

- [86] 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.
- [87] 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

I am actively supporting the Open Source Software (OSS) community.

since 2010 **Initiator, Creator and Maintainer** of the Extend Community Portal – Community-driven Extensions of FOAM

- **Project's Scope & Objective:** The goal of the Extend-Project is to open OpenFOAM to community contributed extensions in the spirit of the Open Source development model.
- **Project Websites:** www.extend-project.de
sourceforge.net/projects/openfoam-extend

since 2009 **Principal Founder** of the CoCoons Project – Community-driven documentation of FOAM technology

- **Project's Scope & Objective:** The goal of the CoCoons Project is to provide *peer and technical reviewed, high-quality documentation* of C++ libraries for Computational Continuum Numerics on Arbitrary Unstructured Meshes in the Open Source Spirit.
- **Partners:** Open Source Press (*Book Publications*) and Elsevier / Computer Physics Communications (*Computer Programs in Physics (CPiP) Papers*)
- **Project Website:** www.cocoons-project.org

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