

Dr.-Ing. Florian Kummer

DATE OF BIRTH: July the 14th, 1981
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Professional background

- 2015 - now Research group leader at the Chair of Fluid Dynamics (FDY), TU Darmstadt
- responsible for multi-phase research group and software development
- 2014 - 2015 Visiting Scholar at the Department of Computational and Applied Mathematics (CAAM), Rice University
- Reference: Prof. Tim Warburton, tim.warburton@gmail.com
- 2013 - 2014 Research Associate at Center for Turbulence Research (CTR), Stanford University
- Reference: Prof. Parviz Moin, moin@stanford.edu.
 - Reference: Prof. Ali Mani, alimani@stanford.edu.
- 2006 – 2012 Research Staff at Chair of Fluid Dynamics (FDY), TU Darmstadt
- Postdoctoral researcher (2011 – 2013), PhD student (2006 – 2011).
 - Successful defense of PhD thesis, with distinction (Nov 2011).
 - Associated student at the *Graduate School of Computational Engineering* (2009 – 2011).

Undergraduate education, misc.:

- 2000 - 2006 Studies of Technical Mathematics, University of Innsbruck
- Master thesis: *Operator splitting for parabolic PDE's*, chosen subject: computer science.
 - Reference: Univ.-Prof. Dr. Alexander Ostermann, alexander.ostermann@uibk.ac.at.
- 2002 - 2003 Military duty service
- 1995 - 2000 Federal Secondary College of Engineering, communications engineering branch

Awards and distinctions

2017	Prize of the Adolf Messer Foundation 2017 (Preis der Adolf Messer Stiftung), endowed with 50,000 €, http://www.adolf-messer-stiftung.de/stiftungspreise/index.php
2013	PhD Award 2013 of the Graduate School CE
2013	GAMM Junior Award 2013/2014.

Publications

Peer-Reviewed Journals:

Articles which have been published or officially accepted by publication outlets with scientific quality assurance and book publications.

- [1] Kummer, F., Müller, B., and Utz, T. (2017). Time integration for extended discontinuous Galerkin methods with moving domains. *International Journal for Numerical Methods in Engineering*, 113(5):767–788
- [2] Utz, T. and Kummer, F. (2017). A high-order discontinuous Galerkin method for extension problems. *International Journal for Numerical Methods in Fluids*, 86(8):509–518
- [3] Krause, D. and Kummer, F. (2017). An incompressible immersed boundary solver for moving body flows using a cut cell discontinuous Galerkin method. *Computers & Fluids*, 153:118–129
- [4] Utz, T., Kummer, F., and Oberlack, M. (2017). Interface-preserving level-set reinitialization for DG-FEM. *International Journal for Numerical Methods in Fluids*, 84(4):183–198
- [5] Müller, B., Krämer-Eis, S., Kummer, F., and Oberlack, M. (2017). A high-order discontinuous Galerkin method for compressible flows with immersed boundaries. *International Journal for Numerical Methods in Engineering*, 110(1):3–30
- [6] Kummer, F. (2017). Extended discontinuous Galerkin methods for two-phase flows: the spatial discretization. *International Journal for Numerical Methods in Engineering*, 109(2):259–289
- [7] Klein, B., Müller, B., Kummer, F., and Oberlack, M. (2016). A high-order discontinuous Galerkin solver for low-Mach number flows. *International Journal for Numerical Methods in Fluids*, 81(8):1097–10363
- [8] Kummer, F. and Warburton, T. (2016). Patch-recovery filters for curvature in discontinuous Galerkin - based level-set methods. *Communications in Computational Physics*, 19(02):329–353
- [9] Müller, B., Kummer, F., and Oberlack, M. (2013). Highly accurate surface and volume integration on implicit domains by means of moment-fitting. *International Journal for Numerical Methods in Engineering*, 96(8):512–528
- [10] Kummer, F. and Oberlack, M. (2013). An extension of the discontinuous Galerkin method for the singular Poisson equation. *SIAM Journal on Scientific Computing*, 35(2):A603–A622

Third-party funding

Successful grant applications:

The following is a list of successful applications for third-party funding, with significant contributions from my side in application and supervision or execution of the project. If not noted otherwise, the principal investigator is Prof. Dr. Martin Oberlack (oberlack@fdy.tu-darmstadt.de).

- **Collaborative Research Center 1194, B06:** Higher Order Schemes for Direct Numerical Simulation for Wetting and De-Wetting Problems based on Discontinuous Galerkin Methods, 1st funding period (2016 – 2020).
- **Research Scholarship:** Discontinuous Galerkin methods for incompressible multi-phase flows, Two year funding for a research stay in the U.S., DFG Project-No: KU2719/1-1, **personal responsibility** (2013 – 2014).
- **Priority Programme 1506, Proj. 8:** Discontinuous Galerkin Simulation of Multiphase flows with Interfacial Equations **two** individual applications for the 1st and 2nd funding period (2010 – 2016).
- **DFG Research Grant:** Theoretical, numerical and experimental investigation of droplet-layers on electrically stressed insulator surfaces, 2 years funding (2012 – 2014).
- **Collaborative Research Centre 568, B05:** Analysis and modeling of generalized boundary condition for the G-equation. 3rd funding period (2007 – 2011).

Invited talks

- **Volkswagen AG, AutoUni Seminar:** *Extended Discontinuous Galerkin: essentiell Netz-freie Simulationsmethoden für bewegte Geometrien und Mehrphasenströmungen* Nov. 2018, Reference: Dr.-Ing. Alexandra Mutzke
- **Numerische Simulation, Mathematisches Institut, Universität zu Köln:** *On the Simulation of Contact Line Dynamics using Sharp-Interface Methods* Nov. 2018, Reference: Prof. Gregor Gassner
- **SimTech Kolloquium, Cluster of Excellence SimTeCH, University of Stuttgart, Germany:** *Extended discontinuous Galerkin methods and their application: immersed boundary and multiphase*, Jun. 2017, Reference: Prof. Claus-Dieter Munz.
- **IRTG Lecture, Transregio 146, TU Darmstadt, Germany:** *Extended Discontinuous Galerkin Methods for flows on instationary domains: fluid-structure interaction and multiphase*, May 2017, Reference: Dr. Giovanni Settanni.
- **Numerical Analysis Seminar, Matematikcentrum, Lund Univesity, Sweden:** *Extended Discontinuous Galerkin Methods for flows on instationary domains: fluid-structure interaction and multiphase*, May 2017, Reference: Prof. Phillip Birken.

- **CompSE Workshop 2016, Aachen Institute for Advanced Study in Computational Engineering Science (AICES), Germany:** *Long-term stability-issues in high-order multiphase flow simulations*, Jun. 2016, Reference: Prof. Marek Behr
- **Center for Turbulence Research Tea Seminar, Stanford University, USA:** *Discontinuous Galerkin methods for multi-phase flows*, Mar. 2013, Reference: Prof. Parviz Moin.
- **Center for Turbulence Research Tea Seminar, Stanford University, USA:** *BoSSS: Bounded Support Spectral Solver, A Generic Discontinuous Galerkin Framework*, May 2009, Reference: Prof. Parviz Moin.

Conference talks

STAB 2018	<i>High-order numerical methods for fluid simulation with dynamic interfaces</i> , 21. DGLR-Fach-Symposium der STAB, Darmstadt, Germany .
XDMS 2017	<i>On the combination of extended Galerkin methods with mesh adaptation</i> , 13 th World Congress on Computational Mechanics, New York, USA .
APS DFD 2017	<i>High-fidelity droplet and bubble simulations using local enrichment</i> , American Physical Society 70 th Annual DFD Meeting, Denver, CO, USA .
X-DMS 2017	Minisymposium Organizer: <i>High-order embedded methods for static and moving domains</i> , together with Prof. Dominik Schillinger, ECCOMAS thematic conference on eXtended Discretization MethodS, June 2017, Umeå, Sweden .
X-DMS 2017	<i>The application of classical temporal integration schemes on problems with moving domain</i> , ECCOMAS thematic conference on eXtended Discretization MethodS, June 2017, Umeå, Sweden .
FEF 2017	<i>Galerkin Methods for fluid dynamical problems with dynamic boundaries: multiphase flows</i> , IACM 19 th International Conference on Finite Elements in Flow Problems, Rome, Italy .
ECCOMAS 2016	<i>High-order discretizations for multiphase flow: choice of basis, preconditioning and temporal discretization</i> , 7 th European congress on computational methods in applies sciences and engineering, Crete Island, Greece .
APS DFD 2015	<i>High-order accurate multi-phase simulations: building blocks and what's tricky about them</i> , American Physical Society 68 th Annual DFD Meeting, Boston, MA, USA .
X-DMS 2015	Minisymposium Organizer: <i>Higher order eXtended discretization methods</i> , together with Björn Müller, TU Darmstadt, ECCOMAS thematic conference on eXtended Discretization MethodS, Ferrara, Italy .
HONOM 2015	<i>High order discretizations for two-phase flow: spatial discretization, curvature evaluation and solver strategies</i> , European Workshop on High Order Nonlinear Numerical Methods, Trient, Italy .
APS DFD 2013	<i>Discontinuous Galerkin methods for multi-phase flows</i> , American Physical Society 66 th Annual DFD Meeting, Pittsburgh, PA, USA .
ECCOMAS 2012	<i>An extended discontinuous Galerkin method for multiphase flows</i> , 6 th European congress on computational methods in applies sciences and engineering, Wien, Austria .

ICNMMF 2012	<i>An Extension to the Discontinuous Galerkin Method, Aiming on Multiphase Problems</i> , International Conference on Numerical methods in Multiphase Flows Pennsylvania State University, University Park, PA, USA .
ICCE 2011	<i>The Extended Discontinuous Galerkin (XDG) method for discontinuous linear PDE's</i> , 2 nd International Conference on Computational Engineering, Darmstadt, Germany .
HONOM 2011	<i>A Discontinuous Galerkin method for Premixed Combustion flow using a Cut-Cell approach</i> , European Workshop on High Order Nonlinear Numerical Methods, Trient, Italy .
FEF 2011	<i>The Cut-Cell DG method</i> , Finite Elements in Fluids conference, Munich, Germany .
CE 2010	<i>A Cut-Cell DG method for Premixed Combustion</i> , International Workshop on Multi-Scale Methods in Computational Engineering, Darmstadt, Germany .
ParCFD 2009	<i>Development of a Discontinuous Galerkin Framework in .NET</i> , Parallel CFD conference, Moffet Field, CA, USA .

Co-supervised PhD Thesis

- Francisco Gutiérrez, M.Sc.: *Direct numerical simulation of the droplet evaporation and combustion using a discontinuous Galerkin scheme*, ongoing project
- Anne Kikker, M.Sc.: *High-order numerical simulation of oscillating viscoelastic droplet*, ongoing project
- Markus Geisenhofer, M.Sc.: *Shock-capturing for high-order discontinuous Galerkin discretizations of compressible flows*, ongoing project
- Martin Smuda, M.Sc.: *Direct numerical simulation of multi-phase flows using extended Discontinuous Galerkin methods*, ongoing project
- Dennis Krause, M.Sc.: *Cut cell immersed boundary method for moving body problems*, ongoing project
- Thomas Utz, M.Sc.: *Level-Set Methods for High-Order DG Schemes*, ongoing project
- Kallendorf, C. (2016). *An Eulerian Discontinuous Galerkin method for the numerical simulation of interfacial transport*. PhD thesis, TU Darmstadt
- Klein, B. (2015). *A high-order Discontinuous Galerkin solver for incompressible and low-Mach number flows*. PhD thesis, TU Darmstadt

Supervised Bachelor- and Master Thesis

- Beck, L. (2018). *Numerical integration over implicitly defined surfaces and volumes*. Master's thesis, TU Darmstadt

- Feifel, P. (2018). Polygonale darstellung fluider grenzflächen. Master's thesis, TU Darmstadt
- Degenhardt, M. (2018). Discontinuous Galerkin methods for incompressible flows: 2D turbulence and solver-performance in 3D. Master's thesis, TU Darmstadt
- Lichtenstein, M. (2017). Numerical investigation of turbulent puffs. Bachelor's Thesis, TU Darmstadt
- Nietz, F. (2017). Investigation of numerical properties and validation of a discontinuous Galerkin method for multi-phase flows. Master's thesis, TU Darmstadt
- Nguyen, C. (2016). Lie-symmetries in numerical methods. Bachelor's Thesis, TU Darmstadt
- Klein, L. (2016). Lie-symmetries in numerical methods: analysis of the effect of mathematical symmetries on simple partial differential equations. Bachelor's Thesis, TU Darmstadt
- Utz, T. (2014). Validation of curved elements for incompressible, viscous flow problems. Master's thesis, TU Darmstadt
- Keil, M. (2012). Erweiterung und Validierung eines stationären SIMPLE-Lösers für zeitabhängige Probleme. Bachelor's Thesis, TU Darmstadt
- Klein, B. (2011). Implementation of the SIMPLE algorithm for solving the steady incompressible Navier-Stokes equations discretized by the discontinuous Galerkin method. Master's thesis, TU Darmstadt
- Ashoori, R. (2009). Numerical solution of the Navier-Stokes equations using the discontinuous Galerkin method. Master's thesis, TU Darmstadt

Teaching experience

- Applied discontinuous Galerkin methods, lecture with exercises, computational engineering and mechanical engineering program, TU Darmstadt since 2016.
- Advanced research project: comparison of linear solvers for flow-problems with a discontinuous Galerkin discretization, computational engineering program, TU Darmstadt, 2015.
- Tutorial on analysis and numerics in fluid mechanics (Tutorium Analysis und Numerik in der Strömungsmechanik), mechanical engineering program, TU Darmstadt since 2015.
- Exercises for advanced fluid mechanics (Fortgeschrittene Strömungsmechanik), mechanical engineering program, TU Darmstadt, 2011-2012.
- Exercises for Hydraulics B, civil engineering program, TU Darmstadt, 2006/2007.

Miscellaneous

- Responsibility for IT equipment, including administration of high-performance-computing (HPC) cluster at the chair of fluid dynamics, from 2008 to 2012, includes *supervision of three IT-trainees*.
 - Reviewer for SIAM Journal for Scientific Computing.
 - Reviewer for International Journal of Computational Fluid Dynamics.
 - Reviewer for Computer and Fluids.
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