Curriculum Vitae: Dr. Dirk Peschka

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Personal Information

Name	Dirk Peschka
Place & Date of Birth	21.11.1977 in Zossen
Marital status	Married (2 Children)
Citizenship	German
Languages	German (native), English (fluent)

Current Position

At the moment I am working as a postdoctoral researcher at the Weierstraß-Institut in Berlin, performing project-oriented research in applied mathematics and theoretical physics.

Research Interests

Modeling:
- electronics and optics (*e.g.* charge transport, semiconductor lasers)
- soft matter problems (*e.g.* viscous flows, complex fluids, granular matter)
- multiphase flows (*e.g.* reacting mixtures, bilayers)
- energetic principles and thermodynamics (*e.g.* multiphysics)

Simulation:
- finite element methods (FEM) (*e.g.* conformal, mixed or higher-order FEM)
- ALE methods for moving domains (*e.g.* grids, isoparametric FEM)
- convection dominated transport (*e.g.* stable discretization, FV schemes)
- degenerate problems (*e.g.* stable higher-order methods)

Mathematics:
- nonlinear higher-order partial differential equations (PDEs)
- variational formulations (*e.g.* gradient flows and their generalization)
- free boundary problems and moving contact lines
- model reduction (*e.g.* matched asymptotic expansions)

Education

2008	**Ph. D. (Dr. rer. nat.) in Mathematics (magna cum laude)** Institut für Mathematik, Humboldt-Universität zu Berlin "Analysis of thin films with slippage"
2005-2008	**Scholarship in the DFG Graduate School 1128** "Analysis, Numerics, and Optimization of Multiphase Problems"
2004-2005	**Scholarship in the DFG Graduate School 271/3-02** "Strukturuntersuchungen, Präzisionstests und Erweiterung des Standardmodells der Elementarteilchenphysik"
2004	**Diploma (Dipl. Phys.) in Physics (mit Auszeichnung)** Institut für Physik, Humboldt-Universität zu Berlin "On the semiclassical structure of QCD–A lattice study at finite temperature"

Professional Experience & Research Projects

2014-present	**Research Associate in the Einstein Center for Mathematics** • researcher in MATHEON projects OT1 & OT8 on optical technologies OT8: "Modeling, analysis, and optimization of optoelectronic semiconductor devices driven by experimental data" (June 2017–present, with M. Thomas) OT1: "Mathematical modeling, analysis, and optimization of strained germanium-microbridges" (2014–2017, with M. Thomas, T. Surowiec, A. Mielke, M. Hintermüller) • member of MATHEON executive board • organization WIAS "Halbleiterseminar" & "Materialmodellierungsseminar" • co-founded a special interest group on computational electronics within the "European Consortium for Mathematics in Industry" (ECMI) • organization minisymposia at applied math conferences (ECM, ECMI, ICIAM) • **software:** semiconductor device simulation and optimization
June–Sept 2014 Sept–Nov 2012 Oct–Nov 2011 July–Oct 2010	**Invited Visiting Researcher at the University of California Los Angeles** • modeling, theory, simulation and experiments of suspension flows (with A. Bertozzi, N. Murisic, B. Pausader, L. Wang) • mentor for REU project and lab supervisor for UCLA applied math lab
June 2010 – May 2014	**Research Associate in the DFG Research Center MATHEON** • researcher in MATHEON project C10 on interface dynamics (with B. Wagner) • **software:** complex fluids and Navier-Stokes flow
June 2010 – May 2016	**Principal Investigator in Priority Programme 1506** • co-PI and project proposer of SPP project (2 funding periods) • mentor for Ph. D. thesis of Sebastian Jachalski • cooperation with R. Seemann and B. Wagner within tandem project • associated to MATHEON as SE-AP15 • **software:** thin-film / Stokes flow with free boundaries
April 2008 – June 2010	**Research Associate in an Industry Project with Océ (a Canon company)** • research on flow instabilities in an innovative printing device • collaboration with E. Bänsch (Univ. Erlangen) from applied mathematics • **software:** particulate flow in an electrolyte
2005-2008	**Ph. D. candidate in DFG Research Training Group 1128** • advisors Prof. A. Münch (Univ. Oxford) and Prof. B. Niethammer (Univ. Bonn)

Cooperations

- **Prof. Alexander Mielke, Prof. Michael Hintermüller, Dr. Marita Thomas, Dr. Nella Rotundo, Dr. Thomas Koprucki, Dr. Matthias Liero and Dr. Annegret Glitzky (all WIAS)**
  Topics: modeling, simulation, optimization, and analysis of semiconductor devices
- **Prof. Ralf Seemann and Prof. Karin Jacobs (Univ. d. Saarlandes)**
  Topics: modeling, validation, simulation of pattern formation processes in multiphase flows
- **Dr. Barbara Wagner (WIAS)**
  Topics: modeling, model reduction, formal asymptotics
- **Prof. Luca Heltai (SISSA, Trieste)**
  Topics: higher-order methods and high-performance computing with the deal.II library
- **Dr. Patricio Farrell (Hamburg Univ. of Technology)**
  Topics: numerical methods for drift-diffusion semiconductor models
- **Prof. Andrea Bertozzi (Univ. of California Los Angeles)**
  Topics: simulation, modeling and experiments for suspension flows
- **Prof. Andreas Münch and Dr. Georgy Kitavtsev (Univ. Oxford)**
  Topics: modeling, asymptotical methods, simulation, applications with fluid flows
- **Prof. Thomas Surowiec (Univ. Marburg)**
  Topics: topology optimization of optoelectronic devices
- **Prof. T. John, Dr. H. Vrijmoed (FU Berlin) and Dr. M. Rosenau (GFZ Potsdam)**
  Topics: modeling and simulation of multiscale geophysical systems
- **Prof. G. Capellini (IHP Frankfurt Oder), Dr. M. Virgilio (Univ. Pisa), Prof. T. Schröder (IKZ)**
  Topics: experiments, modeling, simulation, and optimization of optoelectronic devices

Third Party Funding

In cooperation with Dr. Barbara Wagner (WIAS) and Prof. Ralf Seemann (Univ. Saarbrücken) I successfully applied for a tandem research project (2 full PhD positions) in the DFG SPP 1506 "Transport processes at fluidic interfaces", which after an initial 3 year funding period was extended for another 3 years.

Theses Reviews & Mentoring

- **Fabian Mönkeberg**, "Asymptotic and Numerical Methods for the Two-Dimensional Narrow Escape Problem for Finite-Size Particles", Master Thesis (with B. Wagner), Department of Mathematics, Technische Universität Berlin (2015).
- **Sebastian Jachalski**, "Derivation and Analysis of Lubrication Models for Two-Layer Thin-Films", Ph. D. Thesis, (with B. Wagner and B. Niethammer), Department of Mathematics, Technische Universität Berlin (2014).

Selected Presentations (Invited & Organized)

- "The Stokes flow and thin films with contact lines", Univ. Heidelberg (2018, invited).
- "Motion of thin droplets over surfaces", ICERM Workshop (2017, Providence, USA, invited).
- "Variational structure of fluid motion with contact lines in thin-film models", Universität der Bundeswehr, (2017, München, invited).

- "Modelling and simulation of suspension flow", Univ. Bonn (2017, invited).
- "Towards the optimization of Ge micro-bridges", The 19th European Conference on Mathematics for Industry, (2016, Santiago de Compostela, organized).
- "Thin film free boundary problems—Modelling of contact line dynamics with gradient formulations", CeNoS-Colloquium (2016, Münster, invited).
- "Modelling and applications of bilayer flows", Seminar of the GRK 1276 "Structure Formation and Transport in Complex Systems", (2015, Saarbrücken, invited).
- "Droplets on liquids and their long way into equilibrium", 8th International Congress on Industrial and Applied Mathematics (ICIAM) (2015, Beijing, CHN, organized).
- "Numerics of contact line motion for thin films", MATHMOD 2015, Minisymposium Free Boundary Problems in Applications (2015, Wien, organized).
- "Thin-film equations with free boundaries", Jahrestagung der Deutschen Mathematiker-Vereinigung (DMV), Minisymposium Mathematics of Fluid Interfaces (2015, Hamburg, invited).
- "Liquid/liquid dewetting—Theory and experiments", Workshop Thin Liquid Films and Fluid Interfaces: Models, Experiments and Applications (2012, Banff, CAN, invited).
- "Liquid/liquid dewetting-stationary solutions", Max-Planck-Institut für Mathematik in den Naturwissenschaften, AG Musterbildung (2011, Leipzig, invited).
- "Stationary solutions in liquid/liquid dewetting", University of California Los Angeles, Department of Mathematics, Applied Math. Colloquium, (2011, Los Angeles, USA, invited).
- "Self-similar rupture for thin films with slip", EUROMECH Colloquium 497—Recent Developments and New Directions in Thin-Film Flow (2009, Edinburgh, UK, invited).

The complete list is available at https://www.wias-berlin.de/people/peschka/.

Minisymposium Organization

- "Multiple scales in electromagnetic devices - from quantum mechanical effects to circuit simulation" at The 20th European Conference on Mathematics for Industry (2018, Budapest) organized jointly with N. Rotundo, P. Farrell (WIAS, TUHH).
- "Mathematical methods for semiconductors" at the 7th European Congress of Mathematics (ECM) (2016, Berlin) organized jointly with N. Rotundo and P. Farrell (WIAS, TUHH).
- "Charge transport in semiconductor materials: Emerging and established mathematical topics" at The 19th European Conference on Mathematics for Industry (2016, Santiago de Compostela) organized jointly with N. Rotundo and P. Farrell (WIAS, TUHH).
- "Free Boundary Problems in Applications: Recent Advances in Modelling, Simulation and Optimization" at the MATHMOD (2015, Wien) organized jointly with S.J. Kimmerle (Uni BW München).
- "Recent Progress in Modelling and Simulation of Multiphase Thin-film Type Problems" at the 8th International Congress on Industrial and Applied Mathematics (2015, Beijing, CHN) organized jointly with L. Wang (Univ. Minnesota).
- "Coupled flows and their robust discretisation" at CMAM–5 2012 (Berlin) organized jointly with A. Linke (WIAS).

Publications

[P1] D. Peschka, S. Bommer, S. Jachalski, R. Seemann, and B. Wagner. Impact of energy dissipation on interface shapes and on rates for dewetting from liquid substrates. *Scientific Reports*, 8(1):13295, 2018.

[P2] D. Peschka. Variational approach to contact line dynamics for thin films. *Physics of Fluids*, 30(8):082115, 2018.

[P3] A. Mielke, D. Peschka, N. Rotundo, and M. Thomas. On Some Extension of Energy-Drift-Diffusion Models: Gradient Structure for Optoelectronic Models of Semiconductors. In *European Consortium for Mathematics in Industry*, volume 26, pages 291–298. Springer, 2016.

[P4] D. Peschka. Thin-film free boundary problems for partial wetting. *Journal of Computational Physics*, 295:770–778, 2015.

[P5] R. Huth, S. Jachalski, G. Kitavtsev, and D. Peschka. Gradient flow perspective on thin-film bilayer flows. *Journal of Engineering Mathematics*, 94(1):43–61, 2015.

[P6] S. Jachalski, D. Peschka, A. Münch, and B. Wagner. Impact of interfacial slip on the stability of liquid two-layer polymer films. *Journal of Engineering Mathematics*, 86(1):9–29, 2014.

[P7] N. Murisic, B. Pausader, D. Peschka, and A.L. Bertozzi. Dynamics of particle settling and resuspension in viscous liquid films. *Journal of Fluid Mechanics*, 717:203–231, 2013.

[P8] S. Jachalski, R. Huth, G. Kitavtsev, D. Peschka, and B. Wagner. Stationary solutions of liquid two-layer thin-film models. *SIAM Journal on Applied Mathematics*, 73(3):1183–1202, 2013.

[P9] S. Bommer, F. Cartellier, S. Jachalski, D. Peschka, R. Seemann, and B. Wagner. Droplets on liquids and their journey into equilibrium. *The European Physical Journal E*, 36(8):87, 2013.

[P10] D. Peschka, A. Münch, and B. Niethammer. Self-similar rupture of viscous thin films in the strong-slip regime. *Nonlinearity*, 23(2):409, 2010.