

SIMON WOLFGANG FUNKE

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PERSONAL INFORMATION

Name: Funke, Simon Wolfgang
Date of birth: 17.10.1983
Sex: Male
Nationality: German

POSITIONS

2016 - today **Research Scientist, Simula Research Laboratory, Oslo, Norway.**
2016 - today **MC Member, COST Action TD1307 (European Model Reduction Network).**
2015 - 2017 **Adjoint Associate Professor, University of Oslo, Norway.**
2014 - today **Technical advisor (CTO in 2014), IMERSO AS, Oslo, Norway.**
2013 - 2015 **Postdoctoral Fellow, Simula Research Laboratory, Oslo, Norway.**
In addition, a 20% adjoint PostDoc position in 2014 at Imperial College London, UK.
2014 - 2015 **Consultant, Kalkulo AS, Oslo, Norway.**
2013 - 2014 **Consultant, E.ON AG, Düsseldorf, Germany.**

EDUCATION

2009 - 2013 **PhD, Computational science, Imperial College London, UK.**

- Thesis title: *The automation of PDE-constrained optimisation and its applications.*
- Department of Earth Science and Engineering.
- Supervisors: M.D. Piggott, P.E. Farrell, P.A. Allison, G.J. Gorman.
- Date of approved disputation: 01.03.2013.

2007 **Erasmus, École normale supérieure de Lyon, France.**
2004 - 2009 **Diplom, Mathematics, Technische Universität München, Germany.**

- Passed with high distinction (1.0).
- Thesis title: *Fast solvers for the Navier-Stokes equations on high Reynold numbers.*
- Department of Mathematics.
- The German Diplom is equivalent to a Master degree.
- Supervisor: M. Ulbrich.

AWARDS AND PRIZES

- **Wilkinson Prize for Numerical Software, 2015**

The Wilkinson prize for Numerical Software is a prestigious prize in scientific computing, awarded every four years to the authors of an outstanding piece of numerical software. In 2015, the prize was awarded to Funke and his co-authors P.E. Farrell, D.A. Ham and M.E. Rognes for the high-level AD tool dolfin-adjoint.

- Best Poster Award, CSE 2015
- Imperial College Startup Venture Catalyst Award, 2013
- Imperial College Excellence Award, 2010
- Google Interactivism Award, 2011
- Grantham Institute for Climate Change and Fujitsu CASE Studentship, 2009
- Hurwitz-Association Award for an excellence diploma thesis, 2009

FUNDING

- PI on NOK 7M FRIPRO Young Research Talent “Simulation-based optimisation with dynamic domains”, (#251237/F20), 2016
- EU Horizon 2020 SME instrument, IMERSO AS, 2015

MOBILITY

Studied and worked in research institutions in **Germany, France, UK and Norway** (> 6 months).

Shorter research visits:

- Heidelberg Laureate Forum, Germany (2016)
- Texas A&M University, USA (2015)
- Humboldt University of Berlin, Germany (2013)
- Simula Research Laboratory, Norway (2012)
- Isaac Newton Institute, Cambridge, UK (2012)
- Institut of Atmospheric Physics, Beijing, China (2011).

SUPERVISION

PostDocs: August Johannsson (Simula).

PhD students: Jorgen Dokken (Simula), Dave Culley (Imperial College, co-supervisor).

TEACHING ACTIVITIES

2015 - today **Lecturer**, INF3331/INF4331 Higher-level programming, University of Oslo, Norway.

2017 - today **Python Workshop** NTNU Trondheim (2017, 2 days).

2014 - today **FEniCS/dolfin-adjoint Workshop** UNISA Johannesburg (2016, 1 day), Technical University of Munich (2016, 5 days), SUURPH workshop, Simula (2016, 1 day), Simula (2016, 2 days), Simula (2014, 1 day), Zhejiang University (2014, 5 days).

2010 - 2012 **Teaching assistant** for courses on computational science, programming and mathematics. Department of Earth Science and Engineering, Imperial College London, UK.

COMMISSIONS OF TRUST

2019 **Organiser Committee** ECCOMAS, Young Investigators Conference.

2013 - today **Reviewer** for SIAM Journal on Scientific Computing (SIAM), Computer Physics Communications (Elsevier), Energies (MDPI) and European Wave and Tidal Energy Conference Series and Geoscientific Model Development (GMD), Applied Energy.

2015-today **Examiner** for 2 Master projects.

2015 **Organiser** of a Workshop on Advanced Techniques in Biomedical Computing, *Center for Biomedical Computing*.

2015 **Organiser** of a Mini-symposium on Efficient Solvers for PDE-constrained Optimization, *SIAM CSE15*.

RESEARCH INTEREST/RESEARCH PROFILE

Funke's research interests center around optimisation problems governed by partial differential equations, with a focus on their numerical solution. In particular, he is interested in the automated derivation of adjoint and tangent linear models and their use in optimal control, data inversion and design optimisation. He is a founder of the dolfijn-adjoint project, a software which automatically derives adjoint models from complex computer models solving partial differential equations based on a high-level symbolic problem specification language that mimics mathematical notation.

Funke applies these advances to applications in a wide variety of different domains including renewable energy and bioengineering. For the renewable energy sector, he developed OpenTidalFarm, an open-source software for optimising of tidal turbine farms, such as the optimal position of turbines within the farm. In bioengineering, he develops data assimilation techniques for blood flow simulations, with the aim to tune high-fidelity numerical blood flow models to match with MRI measurements.

BOOKS

1. *T Schwedes, DA Ham, SW Funke, MD Piggott*. Mesh dependence in PDE-constrained optimisation - An Application in Tidal Turbine Array Layouts, *Springer Research Brief*, ISBN 978-3-319-59483-5, 2017.

JOURNAL PUBLICATIONS

1. *ME Rognes, PE Farrell, SW Funke, JE Hake, MMC Maleckar* cbcbeat: an adjoint-enabled framework for computational cardiac electrophysiology, *The Journal of Open Source Software*, , 2017.
2. *SW Funke, PE Farrell, MD Piggott*. Reconstructing wave profiles from inundation data, *Computer Methods in Applied Mechanics and Engineering*, 10.1016/j.cma.2017.04.019, 2017.
3. *MM Noack, SW Funke*. Hybrid Genetic Deflated Newton Method for Global Optimisation, *Journal of Computational and Applied Mathematics*, 10.1016/j.cam.2017.04.047, 2017.
4. *SD Parkinson, SW Funke, J Hill, MD Piggott, PA Allison*. Application of the adjoint approach to optimise the initial conditions of a turbidity current (AdjointTurbidity 1.0), *Geoscientific Model Development (GMD)*, doi:10.5194/gmd-10-1051-2017, 2017.
5. *SW Funke, SC Kramer, MD Piggott*. Design optimisation and resource assessment for tidal-stream renewable energy farms using a new continuous turbine approach, *Renewable Energy*, doi:10.1016/j.renene.2016.07.039, 2016.
6. *DM Culley, SW Funke, SC Kramer, MD Piggott*. Integration of cost modelling within the micro-siting design optimisation of tidal turbine arrays, *Renewable Energy*, doi:10.1016/j.renene.2015.06.013, 2016.
7. *S Rao , H Xue, M Bao, SW Funke*. Determining tidal turbine farm efficiency in the Western Passage using the disc actuator theory, *Ocean Dynamics*, doi:10.1007/s10236-015-0906-y, 2015

8. *PE Farrell, A Birkisson, SW Funke*. Deflation techniques for finding distinct solutions of nonlinear partial differential equations, *SIAM Journal on Scientific Computing*, doi:10.1137/140984798, 2015.
9. *R Venell, SW Funke, S Draper, C Stevens*. Designing Large Arrays of Tidal Turbines: a synthesis and review, *Renewable & Sustainable Energy Reviews*, doi:10.1016/j.rser.2014.08.022, 2015.
10. *SW Funke, PE Farrell, MD Piggott*. Tidal turbine array optimisation using the adjoint approach, *Renewable Energy*, doi:10.1016/j.renene.2013.09.031, 2014.
11. *PE Farrell, CJ Cotter, SW Funke*. A framework for the automation of generalised stability theory. *SIAM Journal on Scientific Computing*, doi:10.1137/12090074, 2014.
12. *PE Farrell, DA Ham, SW Funke, ME Rognes*. Automated derivation of the adjoint of high-level transient finite element programs, *SIAM Journal on Scientific Computing*, doi:10.1137/120873558, 2013.
13. *SW Funke, CC Pain, SC Kramer, MD Piggott*. A wetting and drying algorithm with a combined pressure/free-surface formulation for non-hydrostatic models, *Advances in Water Resources*, doi:10.1016/j.advwatres.2011.

CONFERENCE PUBLICATIONS

1. *JS Dokken, SW Funke, A Johannsson, S Schmidt*. Shape Optimization with Multiple Meshes, *FEniCS 2017 Conference*, PDF, 2017
2. *CT Jacobs, SC Kramer, MD Piggott, SW Funke*. On the validity of tidal turbine array configurations obtained from steady-state adjoint optimisation, *ECCOMAS Congress 2016*, PDF, 2016.
3. *DM Culley, SW Funke, SC Kramer, MD Piggott*. Tidal stream resource assessment through optimisation of array design with quantification of uncertainty, *EWTEC 2015 proceedings*, PDF, 2015.
4. *T Roc, SW Funke, KM Thyng*. Standard methodology for tidal array project optimisation: An idealized study of the Minas Passage, *EWTEC 2015 proceedings*, PDF, 2015.
5. *SC Kramer, SW Funke, MD Piggott*. A continuous approach for the optimisation of tidal turbine farms, *EWTEC 2015 proceedings*, PDF, 2015.
6. *DM Culley, SW Funke, SC Kramer, MD Piggott*. A hierarchy of approaches for the optimal design of tidal turbine arrays, *Proceedings of the 5th International Conference on Ocean Energy*, PDF, 2014.

PHD PROJECTS

2016-today Jorgen Dokken, *PDE-constrained optimisation with dynamic domains*, Simula Research Laboratory

2013-2016 Dave Culley, *The modelling and design optimisation of tidal stream turbine arrays*, Imperial College London