Simon W. Funke

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Personal information

Name: Funke, Wolfgang, Simon

Date of birth: 17.10.1983

Sex: Male

Nationality: German

Web page: http://simonfunke.com

Education

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

- Date of approved disputation: 01.03.2013.
- Department of Earth Science and Engineering.
- Thesis title: *The automation of PDE-constrained optimisation and its applications.*
- Winner of the Imperial College Startup Venture Catalyst Award for innovative PhD results.
- Supervisors: M.D. Piggott, P.E. Farrell, P.A. Allison, G.J. Gorman.

2009 **Diplom, Mathematics, Technische Universität München, Germany**.

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

2007 **Erasmus student, École normale supérieure de Lyon, France**.

Current and previous positions

2015 - today **20% Associate professor, University of Oslo, Norway**.

2013 - today **Postdoctoral Fellow, Simula Research Laboratory, Oslo, Norway**.

2014 - 2015 **Consultant, Kalkulo AS, Oslo, Norway**.

2012 - 2014 **Postdoctoral Fellow, Imperial College London, London, UK**.
20% adjoint position in 2014 in addition to the PostDoc position at Simula Research Laboratory

2013 - 2014 **Consultant, E.ON AG, Düsseldorf, Germany**.

Awards

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

2010 **Imperial College Excellence Award**
This award was received as part of the Applied Modelling And Computation Group, Imperial Collegel London for its high academic achievements and significant future potential.

2009 **Grantham Institute for Climate Change and Fujitsu CASE Studentship**
This PhD studentship was received to develop novel numerical methods on renewable energy using high-performance computing.

Mobility

Studied and worked ($>$ 6 months) in research institutions in **4 different countries**.

Shorter, invited research visits: Texas A&M University, USA (2015), Humboldt University of Berlin, Germany (2013), Simula Research Laboratory, Norway (2012), Institut of Atmospheric Physics, Beijing, China (2011).

Supervision

5 Master&Bachelor students University of Oslo, Norway and Department of Earth Science and Engineering, Imperial College London, UK.

1 PhD student co-supervisor, expected submission date 2016, Department of Earth Science and Engineering, Imperial College London, UK.

Teaching activities

2014 **Invited lecture,** Introduction to PDE-constrained optimisation, Zhejiang University, China.

2010 - 2012 **Tutorial teaching,** several courses on computational science, programming and mathematics. Department of Earth Science and Engineering, Imperial College London, UK.

Commissions of Trust

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

2015 **Mini-symposium organiser,** 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 dolfin-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 developes data assimilation techniques for blood flow simulations, with the aim to tune high-fidelity numerical blood flow models to match with MRI measurements.

Peer reviewed publications

1. *Shivanesh Rao, Huijie Xue, Min Bao, Simon Funke.* Determining Tidal Turbine Farm Efficiency in the Western Passage using the Disc Actuator Theory, *Ocean Dynamics*, accepted, 2015.

2. *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*, in review, 2015.

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*, 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*, 2015.

5. *SC Kramer, SW Funke, MD Piggott.* A continuous approach for the optimisation of tidal turbine farms, *EWTEC 2015 proceedings*, 2015.

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*, 2015.

7. *PE Farrell, A Birkisson, SW Funke.* Deflation techniques for finding distinct solutions of nonlinear partial differential equations, *SIAM Journal on Scientific Computing*, 2015.

8. *R Venell, SW Funke, S Draper, C Stevens.* Designing Large Arrays of Tidal Turbines: a synthesis and review, *Renewable & Sustainable Energy Reviews*, 41, pp. 454-472, 2015.

9. *GL Barnett, SW Funke, MD Piggott.* Hybrid global-local optimisation algorithms for the layout design of tidal turbine arrays, *Renewable Energy*, in review, 2014.

10. *PE Farrell, SW Funke.* Exploiting high-level structure in algorithmic differentiation, in review, 2014.

11. *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, 2014.

12. *SW Funke, PE Farrell, MD Piggott.* Tidal turbine array optimisation using the adjoint approach, *Renewable Energy*, 63, pp. 658-673, 2014.

13. *PE Farrell, CJ Cotter, SW Funke.* A framework for the automation of generalised stability theory. *SIAM Journal on Scientific Computing*, 36(1) pp. C25-C48, 2014.

14. *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*, 35(4), pp. C369-C393, 2013.

15. *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*, 2011.

Dissemination: selected presentations

Best poster award, dolfin-adjoint, automated adjoint models for FEniCS, *SIAM Conference on Computational Science*, Salt Lake City, USA, 2015

Tidal Farm Layout Optimisation and Resource Assessment based on PDE-constrained optimisation, *International Conference on Ocean Energy*, Halifax, Canada, 2014

Invited talk, Introduction to FEniCS and automated adjoints, *Norwegian Meteorological Institute*, Oslo, Norway, 2014

PDE-constrained optimisation in Hilbert spaces, *FEniCS'14*, Paris, France, 2014

Invited talk An introduction to libadjoint, Institut of Atmospheric Physics, Beijing, China, July 2011