



Andreas Rupp

Curriculum Vitae

Personal Data

Date of birth	April 04, 1992	Office address	LUT University
Place of birth	Roth, Germany		P.O. Box 20
Nationality	German		53851 Lappeenranta

Education

- 05/2019 **Ph.D. in Applied Mathematics** (minor: soil science), *summa cum laude*, University Erlangen–Nuremberg, Erlangen, Germany
- 12/2015 **Master of Science in Mathematics** (minor: computer science), University Erlangen–Nuremberg, Erlangen, Germany
- 08/2014 **Bachelor of Science in Mathematics** (minor: computer science), University Erlangen–Nuremberg, Erlangen, Germany

Awards and Honours

- 11/2023–10/2028 **Docent** (adjunct professor), *Applied mathematics*, School of Science, Aalto-yliopisto (Aalto University)
- 09/2023–08/2027 Invited member of the **Young Academy Finland**, Academia Scientiarum Fennica / Finnish Academy of Science and Letters
- 05/2023–04/2028 **Docent** (adjunct professor), *Numerical analysis of partial differential equations*, School of Engineering Sciences, Lappeenranta–Lahti University of Technology
- 10/2020 **Staedtler Promotionspreis**, *Staedtler foundation's award for an outstanding doctoral thesis (top ten at University of Erlangen-Nuremberg in 2019)*

Professional Experience

- 09/2023–08/2027 **Academy Research Fellow**, *Uncertainty quantification for PDEs on hypergraphs*, Lappeenranta–Lahti University of Technology
- 06/2021–06/2025 **Assistant Professor** (tenure track), Computational Engineering, School of Engineering Science, Lappeenranta–Lahti University of Technology
Leave of absence: 09/2023–06/2025

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- 04/2019– **Research Associate**, *DFG EXC 2181 STRUCTURES – Project: Modeling large*
 06/2021 *near-fractal pre-planetary dust aggregates*, Heidelberg University
 Principal investigators: Prof. Cornelis Dullemond, Prof. Guido Kersch
- 01/2016– **Research Assistant**, *DFG RU 2179 MAD Soil – Project: Mechanistic modelling*
 04/2019 *of the formation and consolidation of soil microaggregates*, University Erlangen–
 Nuremberg
 Principal investigators: Dr. Alexander Prechtel, Dr. Nadja Ray
- 04/2015– **Research Assistant**, Chair of Applied Mathematics I, Department of Mathematics,
 04/2019 University Erlangen–Nuremberg

Grants and Research Funding

Please visit <https://andreas-rupp.eu/research-projects/> for more details.

- 08/2024– **Call for Doctoral Education Pilot Projects in Finnish Flagship Areas**, *Doctoral*
 12/2027 *education pilot for mathematics of sensing, imaging and modelling*, 25,500,000 €
 (3,570,000 € for Lappeenranta–Lahti University of Technology), Principal investigator
 Finnish Ministry of Education and Culture
- 03/2024– **Funding for Mobility Cooperation with Germany**, *Localized orthogonal decom-*
 02/2026 *position for high-order, hybrid finite elements*, 18,000 €, Principal investigator
 Research Council of Finland
- 01/2024– **Program for Project-Related Personal Exchange with Finland**, *High-order*
 12/2025 *hybrid multiscale methods for rough heterogeneous structures*, 15,907 €, Principal
 investigator in Finland
 German Academic Exchange Service
- 01/2024– **Flagship Program**, *Flagship of advanced mathematics for sensing, imaging and*
 04/2028 *modelling*, 7,999,994 € (1,033,328 € for Lappeenranta–Lahti University of Technol-
 ogy), Principal investigator
 Research Council of Finland
- 09/2023– **Academy Research Fellow**, *Uncertainty quantification for PDEs on hypergraphs*,
 08/2027 667,532 € + 286,086 €, Principal investigator
 Academy of Finland
- 05/2023– **Co-Innovation Project**, *3D-Cure: 3D printing for personalized medicine and*
 04/2025 *customized drug delivery*, 2,165,093 € + 927,897 € (139,930 € + 59,970 € for
 Lappeenranta–Lahti University of Technology), Project manager
 Business Finland
- 02/2022– **Funding for Mobility Cooperation with Germany**, *Mathematical models and*
 02/2024 *numerical methods for water management in soils*, 18,000 €, Principal investigator
 Academy of Finland
- 01/2022– **Program for Project-Related Personal Exchange with Finland**, *Discontinuous*
 12/2023 *Galerkin methods and parameter estimation for microstructure models in porous*
media, 15,892 €, Principal investigator in Finland
 German Academic Exchange Service

Invited Visiting Researcher

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- Bayreuth, DE, multiple
- Bergen, NO, 08/2016
- Berlin, DE, 07/2022
- Dortmund, DE, multiple
- Espoo, FI, multiple
- Gothenburg, SE, 02/2024
- Hanover, DE, 02/2019
- Heidelberg, DE, multiple
- Helsinki, FI, multiple
- Jena, DE, multiple
- Kigali, RW, multiple
- Kuopio, 10/2021
- Portland, US, 01/2024
- Stuttgart, DE, 06/2017
- Sydney, AUS, 02/2023
- Turku, FI, multiple

Research Output

- 27 peer-reviewed journal articles
- 6 arXiv preprints
- 2 submitted, unpublished manuscripts
- 3 published software packages

Teaching

Lectures at Lappeenranta–Lahti University of Technology

- Mathematical Modeling with PDEs
- Numerical Methods 2
- Scientific Computing
- Seminar on Comp. Engineering

Tutorials at University Erlangen–Nuremberg

- Analysis I, II, III
- Introduction to Functional Analysis
- Numerical Methods for PDEs
- Advanced Numerics for PDEs
- Mathematics for Engineers

Invited Visiting Lecturer

- 03/2024 **Numerical Analysis**, 15 lectures, African Institute for Mathematical Sciences Rwanda, Kigali, Rwanda
- 06/2023 **Mathematical Concepts of Artificial Intelligence**, Summer School “First Steps in Biosphere-Atmosphere Modelling”, Lahti, Finland
- 04/2023 **Artificial Intelligence in Atmospheric Science**, University of Helsinki, Helsinki, Finland
- 03/2023 **Numerical Analysis**, 15 lectures, African Institute for Mathematical Sciences Rwanda, Kigali, Rwanda
- 03/2022 **Numerical Methods for Climate Science**, 15 lectures, African Institute for Mathematical Sciences Rwanda, Kigali, Rwanda

Pedagogical Training

- 03/2023 **Digital Tools for Effective Teaching**, 4 credits (ECTS), Tampere University of Applied Sciences, Lappeenranta, Finland
- 03/2023 **Building Pedagogical Skills in Modern Learning Environment**, 3 credits (ECTS), Tampere University of Applied Sciences, Lappeenranta, Finland
- 03/2023 **Development Work**, 3 credits (ECTS), Tampere University of Applied Sciences, Lappeenranta, Finland

Thesis Supervision

- 1 Ph.D. theses

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- 8 Master's theses and equivalent works
- 5 Bachelor's theses

Further Scientific Activities

Expert evaluator

2022/2023 **INRIA team AIRSEA**, jointly with Heikki Haario

Reviewing for Scientific Journals

- | | |
|----------------------------|-------------------------------|
| ○ Adv Comput Math | ○ Esaim Math Model Numer Anal |
| ○ Appl Numer Math | ○ IMA J. Numer. Anal. |
| ○ BIT Numer. Math. | ○ Int. J. Heat Mass Transf. |
| ○ Commun Comput Phys | ○ J Sci Comput |
| ○ Comput. Appl. Math. | ○ SIAM J Sci Comput |
| ○ Comput. Math. with Appl. | |

Conference Organization

2023 **BayesComp 2023 Satellite Event: Uncertainty quantification and inverse problems**, March 12 – 14, Levi, Finland, URL: <https://bayescomp2023.com>, A. Rupp, V. Kaarnioja, J. de Wiljes, and M. Simon

2020 **Modeling and Simulation of Transport Phenomena**, October 12 – 15, Treis-Karden, Germany, URL: <http://most2020.math.tu-dortmund.de>, D. Kuzmin, V. Aizinger, F. Frank, A. Rupp, H. Hajduk, and J. Gröll

Organization of Minisymposia

- ongoing **Discretization methods involving multiple levels and scales**, M. Hauck, R. Maier, and A. Rupp, SciCADE 2024 – International Conference on Scientific Computation And Differential Equations
- 03/2024 **Structure-preserving finite element methods for computational fluid dynamics, invited minisymposium**, D. Kuzmin and A. Rupp, ALGORITHM 2024: Central-European Conference on Scientific Computing
- 09/2023 **Multilevel and multiscale methods for PDEs, 3 parts**, R. Maier and A. Rupp, European Conference on Numerical Mathematics and Advanced Applications 2023
- 09/2023 **Theoretical and computational aspects of the discontinuous Galerkin method, 3 parts**, V. Aizinger and A. Rupp, European Conference on Numerical Mathematics and Advanced Applications 2023
- 08/2023 **Regularization models and sampling algorithms in statistics and inverse problems, 2 parts**, F. Uribe and A. Rupp, ICIAM 2023: The 10th International Congress on Industrial and Applied Mathematics
- 03/2019 **Advances in hybrid numerical methods for porous media applications**, A. Rupp, A. Ern, and P. Knabner, SIAM Conference on Mathematical & Computational Issues in the Geosciences
- 03/2019 **Advances in coupling surface flow to subsurface systems, 2 parts**, I. Rybak and A. Rupp, SIAM Conference on Mathematical & Computational Issues in the Geosciences

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Invited Keynote Presentations

- 2024 **Finnish Mathematical Days**, January 4 – 5, Espoo, Finland, URL: <https://mathdays24.math.aalto.fi/>

Recent Conference Talks

- 2024 **ALGORITMY: Central-European Conference on Scientific Computing**, March 15 – 20, High Tatra Mountains, Slovakia
- 2024 **Seventh Chilean Workshop on Numerical Analysis of Partial Differential Equations**, January 15 – 19, Concepción, Chile
- 2023 **Inverse Days 2023**, December 11 – 15, Lahti, Finland
- 2023 **European Conference on Numerical Mathematics and Advanced Applications (ENUMATH) 2023**, September 4 – 8, Lisbon, Portugal
- 2023 **ICIAM 2023: 2023 International Congress on Industrial and Applied Mathematics**, August 20 – 25, Tokyo, Japan
- 2023 **The 29th Biennial Numerical Analysis Conference**, June 27 – 30, Glasgow, United Kingdom
- 2023 **9th Workshop on High-Dimensional Approximation**, February 20 – 24, Canberra, Australia
- 2022 **MultiMat 2022: 10th International Conference on Numerical Methods for Multi-Material Fluid Flow**, August 22 – 26, Zürich, Switzerland
- 2022 **28th Nordic Congress of Mathematicians**, August 18 – 21, Espoo, Finland
- 2022 **15th International Conference on Monte Carlo and Quasi-Monte Carlo Methods in Scientific Computing**, July 17 – 22, Linz, Austria

Andreas Rupp

List of Publications

Please visit <https://andreas-rupp.eu/publications/> for the full bibliographic details.

Theses

- 2019 **Simulating Structure Formation in Soils across Scales using Discontinuous Galerkin Methods**, *Doctoral Thesis*, University Erlangen–Nuremberg,
Shaker: DOI: 10.2370/9783844068016, ISBN: 978-3-8440-6801-6,
OPUS: URN: urn:nbn:de:bvb:29-opus4-112528,
Supervisor: Prof. Peter Knabner (University Erlangen–Nuremberg)
Reviewers: Prof. Albert J. Valocchi (University of Illinois),
Prof. Alexandre Ern (Université Paris-Est)
Shaker Verlag GmbH & OPUS FAU – Online publication system of FAU Erlangen–Nuremberg
- 2015 **A Discontinuous Galerkin Model of Coupled Surface and Subsurface Flow in a Vertical Two-Dimensional Slice**, *Master's Thesis*, University Erlangen–Nuremberg,
Supervisors: Prof. Vadym Aizinger, Prof. Peter Knabner
- 2014 **Numerische Studien zur Strukturbildung in Böden durch Mineralreaktionen (Numerical Studies on Mineral Reactions Inducing Structure Formation in Soils)**, *Bachelor's Thesis*, University Erlangen–Nuremberg,
Supervisors: Prof. Peter Knabner, Dr. Alexander Prechtel

Book Contributions

- 2021 **Numerical Methods for Elliptic and Parabolic Partial Differential Equations: With contributions by Andreas Rupp, P. Knabner and L. Angermann**, Springer International Publishing, DOI: 10.1007/978-3-030-79385-2

27 Journal Articles

- 2024 **Error estimates for completely discrete FEM in energy-type and weaker norms**, *L. Angermann, P. Knabner, and A. Rupp*, Numerical Methods for Partial Differential Equations, DOI: 10.1002/num.23106
- 2023 **Homogeneous multigrid method for HDG applied to the Stokes equation**, *P. Lu, W. Wang, G. Kanschat, and A. Rupp*, IMA Journal of Numerical Analysis, DOI: 10.1093/imanum/drad079
- 2023 **Hybridizable discontinuous Galerkin method with mixed-order spaces for non-linear diffusion equations with internal jumps**, *M. Musch, A. Rupp, V. Aizinger, and P. Knabner*, GEM – International Journal on Geomathematics, DOI: 10.1007/s13137-023-00228-7

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- 2023 **Two-level Schwarz methods for hybridizable discontinuous Galerkin methods**, *P. Lu, A. Rupp, and G. Kanschat*, Journal of Scientific Computing, DOI: 10.1007/s10915-023-02121-9
- 2023 **Analysis of algebraic flux correction schemes for semi-discrete advection problems**, *H. Hajduk and A. Rupp*, BIT Numerical Mathematics, DOI: 10.1007/s10543-023-00957-z
- 2022 **Analysis of injection operators in geometric multigrid solvers for HDG methods**, *P. Lu, A. Rupp, and G. Kanschat*, SIAM Journal on Numerical Analysis, DOI: 10.1137/21M1400110
- 2022 **Partial differential equations on hypergraphs and networks of surfaces: Derivation and hybrid discretizations**, *A. Rupp, M. Gahn, and G. Kanschat*, ESAIM: Mathematical Modelling and Numerical Analysis, DOI: 10.1051/m2an/2022011
- 2021 **Limiter-based entropy stabilization of semi-discrete and fully discrete schemes for nonlinear hyperbolic problems**, *D. Kuzmin, H. Hajduk, and A. Rupp*, Computer Methods in Applied Mechanics and Engineering, DOI: 10.1016/j.cma.2021.114428
- 2021 **Homogeneous multigrid for embedded discontinuous Galerkin methods**, *P. Lu, A. Rupp, and G. Kanschat*, BIT Numerical Mathematics, DOI: 10.1007/s10543-021-00902-y
- 2021 **Homogeneous multigrid for HDG**, *P. Lu, A. Rupp, and G. Kanschat*, IMA Journal of Numerical Analysis, DOI: 10.1093/imanum/drab055
- 2021 **A subcell-enriched Galerkin method for advection problems**, *A. Rupp, M. Hauck, and V. Aizinger*, Computers & Mathematics with Applications, DOI: 10.1016/j.camwa.2021.04.010
- 2020 **Enriched Galerkin method for the shallow-water equations**, *M. Hauck, V. Aizinger, F. Frank, H. Hajduk, and A. Rupp*, GEM – International Journal on Geomathematics, DOI: 10.1007/s13137-020-00167-7
- 2020 **FESTUNG 1.0: Overview, usage, and example applications of the MATLAB/GNU Octave toolbox for discontinuous Galerkin methods**, *B. Reuter, H. Hajduk, A. Rupp, F. Frank, V. Aizinger, and P. Knabner*, Computers & Mathematics with Applications, DOI: 10.1016/j.camwa.2020.08.018
- 2020 **Continuous Galerkin and enriched Galerkin methods with arbitrary order discontinuous trial functions for the elliptic and parabolic problems with jump conditions**, *A. Rupp and S. Lee*, Journal of Scientific Computing, DOI: 10.1007/s10915-020-01255-4
- 2020 **FESTUNG: A MATLAB/GNU Octave toolbox for the discontinuous Galerkin method. Part IV: Generic problem framework and model-coupling interface**, *B. Reuter, A. Rupp, V. Aizinger, F. Frank, and P. Knabner*, Communications in Computational Physics, DOI: 10.4208/cicp.0A-2019-0132
- 2020 **Locally bound-preserving enriched Galerkin methods for the linear advection equation**, *D. Kuzmin, H. Hajduk, and A. Rupp*, Computers & Fluids, DOI: 10.1016/j.compfluid.2020.104525

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- 2020 **Numerical benchmark study for flow in highly heterogeneous aquifers**, *C. Alecsa, I. Boros, F. Frank, P. Knabner, M. Nechita, A. Prechtel, A. Rupp, and N. Suciu*, *Advances in Water Resources*, DOI: 10.1016/j.advwatres.2020.103558
- 2019 **Application of a cellular automaton method to model the structure formation in soils under saturated conditions: A mechanistic approach**, *A. Rupp, T. Guhra, A. Meier, A. Prechtel, T. Ritschel, N. Ray, and K.U. Totsche*, DOI: 10.3389/fenvs.2019.00170, *Frontiers in Environmental Science*
- 2019 **Bound-preserving flux limiting schemes for DG discretizations of conservation laws with applications to the Cahn–Hilliard equation**, *F. Frank, A. Rupp, and D. Kuzmin*, *Computer Methods in Applied Mechanics and Engineering*, DOI: 10.1016/j.cma.2019.112665
- 2019 **Beyond Kozeny–Carman: Predicting the permeability in porous media**, *R. Schulz, N. Ray, S. Zech, A. Rupp, and P. Knabner*, *Transport in Porous Media*, DOI: 10.1007/s11242-019-01321-y
- 2019 **Discontinuous Galerkin method for coupling hydrostatic free surface flows to saturated subsurface systems**, *B. Reuter, A. Rupp, V. Aizinger, and P. Knabner*, *Computers & Mathematics with Applications*, DOI: 10.1016/j.camwa.2018.12.020
- 2018 **Discrete–continuum multiphase model for structure formation in soils including electrostatic effects**, *A. Rupp, K.U. Totsche, A. Prechtel, and N. Ray*, *Frontiers in Environmental Science*, DOI: 10.3389/fenvs.2018.00096
- 2018 **Old and new approaches predicting the diffusion in porous media**, *N. Ray, A. Rupp, R. Schulz, and P. Knabner*, *Transport in Porous Media*, DOI: 10.1007/s11242-018-1099-x
- 2018 **A local discontinuous Galerkin scheme for Darcy flow with internal jumps**, *A. Rupp, P. Knabner, and C. Dawson*, *Computational Geosciences*, DOI: 10.1007/s10596-018-9743-7
- 2017 **Analysis of a mixed discontinuous Galerkin method for instationary Darcy flow**, *V. Aizinger, A. Rupp, J. Schütz, and P. Knabner*, *Computational Geosciences*, DOI: 10.1007/s10596-017-9682-8
- 2017 **Discrete–continuum multiscale model for transport, biomass development and solid restructuring in porous media**, *N. Ray, A. Rupp, and A. Prechtel*, *Advances in Water Resources*, DOI: 10.1016/j.advwatres.2017.04.001
- 2017 **Convergence order estimates of the local discontinuous Galerkin method for instationary Darcy flow**, *A. Rupp and P. Knabner*, *Numerical Methods for Partial Differential Equations*, DOI: 10.1002/num.22150

1 Conference Proceedings

- 2024 **Reinforcement approach using topology optimization**, *R. Altunay, E. Immonen, J. Suuronen, A. Rupp, and L. Roininen*, *Communications of the European Council for Modelling and Simulation*, URL: <https://scs-europe.net/conf/ecms2024/ecms2024proceedings.pdf>

6 Preprints

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- 2024 **Recovery of transversely-isotropic elastic material parameters in induction motor rotors**, *H.M. Cheng, T. Helin, V.P. Manninen, T. Holopainen, J. Jokinen, S. Sorvari, and A. Rupp*, URL: <https://arxiv.org/abs/2405.06388>
- 2024 **Homogeneous multigrid for hybrid discretizations: application to HHO methods**, *D.A. Di Pietro, Z. Dong, G. Kanschat, P. Matalon, and A. Rupp*, URL: <https://inria.hal.science/hal-04518103>
- 2023 **Denture reinforcement via topology optimization**, *R. Altunay, K. Vesterinen, P. Alander, E. Immonen, A. Rupp, and L. Roininen*, URL: <https://arxiv.org/abs/2309.00396>
- 2023 **A localized orthogonal decomposition strategy for hybrid discontinuous Galerkin methods**, *P. Lu, R. Maier, and A. Rupp*, URL: <https://arxiv.org/abs/2307.14961>
- 2023 **Parameter estimation for cellular automata**, *A. Kazarnikov, N. Ray, H. Haario, J. Lapalainen, and A. Rupp*, URL: <https://arxiv.org/abs/2301.13320>
- 2022 **Quasi-Monte Carlo and discontinuous Galerkin**, *V. Kaarnioja and A. Rupp*, URL: <https://arxiv.org/abs/2207.07698>

2 Submitted Manuscripts

- 2023 **phepy: Visual benchmarks and improvements for out-of-distribution detectors**, *J. Tyree, A. Rupp, P. Clusius, and M. Boy*
- 2022 **A local discontinuous Galerkin method with varying polynomial orders for advection–diffusion problems**, *A. Rupp, V. Aizinger, and B. Reuter*

3 Software

- **ecdf_estimator: Parameter estimation with empirical cumulative distribution functions**, *A. Rupp*, Python, https://github.com/AndreasRupp/ecdf_estimator/
- 2022 **HyperHDG: Hybrid discontinuous Galerkin methods for PDEs on hypergraphs**, *A. Rupp and G. Kanschat*, C++ and Python, <https://github.com/HyperHDG/>
- 2014 **FESTUNG: The Finite Element Simulation Toolbox for UNstructured Grids**, *F. Frank, B. Reuter, V. Aizinger, H. Hajduk, and A. Rupp*, MATLAB, <https://github.com/FESTUNG/>

Andreas Rupp

List of Supervised Theses

Please visit <https://andreas-rupp.eu/supervised-theses/> for the full bibliographic details.

1 Ph.D. Theses

ongoing **Topology Optimization of Denture Structures**, *Rabia Altunay*, Lappeenranta–Lahti University of Technology

8 Master's Theses and Equivalent

12/2023 **Spatial Decomposition Methods for Modelling Multi-Resolution European Electricity Systems with High Shares of Renewables**, *G Harish Kaushik*, Lappeenranta–Lahti University of Technology

06/2023 **Modelling Water Reinjection after Methane Extraction in Lake Kivu**, *Jean Modeste Mushimiyimana*, Lappeenranta–Lahti University of Technology

05/2023 **Artificial Intelligence versus Statistical Methods in Parameter Estimation for Discrete Models**, *Ouraga Aime Cevert Ballou*, African Institute for Mathematical Sciences Rwanda

05/2023 **Identifying Hidden Parameters in Cellular Automata with Neural Networks**, *Valery Ashu*, Lappeenranta–Lahti University of Technology

04/2023 **Prudent Response Surface Models: Exploring a Framework for Approximating Simulations with Confidence and Certainty**, *Juniper Tyree*, University of Helsinki

06/2022 **Modeling the Temperature in Lake Kivu**, *Désiré Kabuya*, African Institute for Mathematical Sciences Rwanda

03/2020 **Analysis and Implementation of an Enriched Galerkin Scheme for the Shallow Water Equations**, *Moritz Hauck*, University Erlangen–Nuremberg

07/2018 **A Hybridizable Discontinuous Galerkin Scheme with Different Orders of Approximation Spaces Capable of Dealing with Jump Conditions: Analysis and Implementation**, *Markus Musch*, University Erlangen–Nuremberg

5 Bachelor's Theses

05/2024 **Empirical Cumulative Distribution Functions for Calibrating Random Processes**, *Veeti Rajaniemi*, Lappeenranta–Lahti University of Technology

08/2023 **Parameter Estimation for Cellular Automata**, *Joona Lappalainen*, Lappeenranta–Lahti University of Technology

05/2023 **Man vs Machine: Beating Humans in a Multiplayer Card Game without Look-ahead**, *Ilmari Vahteristo*, Lappeenranta–Lahti University of Technology

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- 12/2018 **Stabilization Techniques for the Finite Element Method Applied on Advection Dominated Problems**, *Moritz Hauck*, University Erlangen–Nuremberg
- 12/2018 **Jacobian-Free Newton–Krylov Methods Applied to the Cahn–Hilliard Equation with Degenerate Mobility**, *Tim Roith*, University Erlangen–Nuremberg