Håkon Hoel

Curriculum Vitae

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Address: RWTH Aachen University
Chair of Mathematics for UQ
Kackertstraße 9 c/ 3 OG
52072 Aachen
Germany
Phone: +49 01743503550
Email: hoel@uq.rwth−aachen.de

Education

2012 PhD in Numerical Analysis at KTH Royal Institute of Technology
2006 MSc in Computational Science at University of Oslo
2004 BSc in Computational Science at University of Oslo

Academic positions

Aug 2019 –	Junior Professor at Department of Mathematics, RWTH Aachen
Jul 2018 –	Visiting researcher at Division of Computer, Electrical and Mathematical Sciences and Engineering (CEMSE), KAUST university
Dec 2017 – Jun 2018	Guest teacher at Department of Mathematical Sciences University of Gothenburg (GU) and Chalmers University of Technology
Nov 2016 – Nov 2017	PostDoc at Mathematics Institute of Computational Science and Engineering, École Polytechnique Fédérale de Lausanne (EPFL)
Oct 2014 – Oct 2016	PostDoc at Department of Mathematics, University of Oslo (UiO)
Aug 2012 – Sept 2014	PostDoc at the CEMSE division, KAUST

Research interests

➤ a posteriori error analysis and adaptive numerics for stochastic differential equations and stochastic partial differential equations,

➤ analysis and implementation of Multilevel Monte Carlo methods,

➤ stochastic conservation laws,

➤ Bayesian statistics and nonlinear filtering methods,

➤ molecular dynamics and quantum mechanics.

Academic work experience

Teaching activities

Spring 2018	Lecturer in Linear Algebra (MVE520) and Linear Algebra and Numerical Analysis (TMA671), GU and Chalmers
Fall 2017	Teaching Assistant (TA) in Stochastic Simulations (MATH-414), EPFL
Spring 2017	TA in Advanced Analysis II (MATH-105), EPFL
Fall 2016	TA in Introduction to PDE (MATH-300), EPFL
Spring 2015	TA in Applications of Linear Algebra (MAT-INF2360), UiO
2007–2012	TA in Introductory Numerical Analysis, KTH
Fall 2011	TA in Numerical Methods for PDE, KTH
Spring 2010	TA in Numerical Methods for SDE, KTH
Spring 2007	TA in Partial Differential Equations (INF-MAT3360), UiO
Fall 2003	TA in Modeling and Computations (MAT-INF1100), UiO

Supervision of students

Co-supervision of MSc student Nadhir Ben Rached for his degree in Applied Mathematics and Computational Science, KAUST, 2013.
Co-supervision of PhD student Gaukhar Shaimerdenova in KAUST, on the topic numerical methods for filtering (ongoing in 2020).

Peer reviews for scientific journals and proceedings

Afrika Statistica, AIMS Foundations of Data Science, BIT Numerical Mathematics, Calcolo, Electronic Journal of Qualitative Theory of Differential Equations, Elsevier Applied Mathematics and Computations, MathSciNet Mathematical Reviews, MCQMC 2014 conference proceedings, Quantitative Finance, SIAM Journal on Numerical Analysis, SIAM Journal on Scientific Computing, SIAM/ASA Journal on Uncertainty Quantification, Springer Statistics and Computing, Springer Stochastic and Partial Differential Equations: Analysis and Computations.

Organizational work

Co-organized minisymposia:

➤ "Advanced multilevel Monte Carlo methods" at SciCADE 2015, Potsdam, Germany

➤ "Analysis and numerical methods for conservation laws with stochastic terms" at ENUMATH 2019, Egmond aan Zee, The Netherlands

Language skills (using a 1-5 scale with 5 being the best)

Norwegian (5), English (4), Swedish (4), German (2)

Programming skills (using a 1-5 scale with 5 being the best)

Java (4), Matlab (4), Python(3), Julia (2), C (2) and C++ (2).

Publications

Theses

1. Hoel, Håkon (2006). "Constructible DP solutions". MSc thesis. Univeristy of Oslo.

2. Hoel, Håkon (2012). "Complexity and Error Analysis of Numerical Methods for Wireless Channels, SDE, Random Variables and Quantum Mechanics". PhD thesis. KTH, Royal Institute of Technology.

Peer reviewed publications

1. Hoel, Håkon A. (2007). A numerical scheme using multi-shockpeakons to compute solutions of the Degasperis-Procesi equation. *Electron. J. Differential Equations*, No. 100, 22 pp. (electronic).

2. Hoel, Håkon, Erik von Schwerin, Anders Szepessy, and Raúl Tempone (2012). "Adaptive multilevel Monte Carlo simulation". In: *Numerical analysis of multiscale computations*. Vol. 82. Lect. Notes Comput. Sci. Eng. Springer, Heidelberg, pp.217–234.

3. Bayer, Christian, Håkon Hoel, Erik von Schwerin, and Raúl Tempone (2014). On nonasymptotic optimal stopping criteria in Monte Carlo simulations. *SIAM J. Sci. Comput.* **36**(2), A869–A885.

4. Hoel, Håkon and Henrik Nyberg (2014). An Extension of Clarke's Model With Stochastic Amplitude Flip Processes. *IEEE Transactions on Communications* **62**(7), 2378–2389.

5. Hoel, Håkon, Erik von Schwerin, Anders Szepessy, and Raúl Tempone (2014). Implementation and analysis of an adaptive multilevel Monte Carlo algorithm. *Monte Carlo Methods Appl.* **20**(1), 1–41.

6. Bayer, Christian, Håkon Hoel, Ashraful Kadir, Petr Plecháč, Mattias Sandberg, and Anders Szepessy (2015). Computational error estimates for Born-Oppenheimer molecular dynamics with nearly crossing potential surfaces. *Appl. Math. Res. Express. AMRX* (2), 329–417.

7. Hall, Eric Joseph, Håkon Hoel, Mattias Sandberg, Anders Szepessy, and Raúl Tempone (2016). Computable Error Estimates for Finite Element Approximations of Elliptic Partial Differential Equations with Rough Stochastic Data. *SIAM Journal on Scientific Computing* **38**(6), A3773–A3807.

8. Hoel, Håkon, Juho Häppölä, and Raúl Tempone (2016). "Construction of a Mean Square Error Adaptive Euler–Maruyama Method With Applications in Multilevel Monte Carlo". In: *Monte Carlo and Quasi-Monte Carlo Methods: MCQMC, Leuven, Belgium, April 2014*. Cham: Springer International Publishing, pp. 29–86.

9. Hoel, Håkon, Kody J. H. Law, and Raul Tempone (2016). Multilevel ensemble Kalman filtering. *SIAM J. Numer. Anal.* **54**(3), 1813–1839.

10. Hoel, Håkon, Kenneth H. Karlsen, Nils H. Risebro, and Erlend B. Storrøsten (2018). Path-dependent convex conservation laws. *Journal of Differential Equations* **265**(6), 2708–2744.

11. Hoel, Håkon, Kenneth Hvistendahl Karlsen, Nils Henrik Risebro, and Erlend Briseid Storrøsten (2018). Numerical methods for conservation laws with rough flux. *Stochastics and Partial Differential Equations: Analysis and Computations*, 1–76.

12. Hoel, Håkon and Sebastian Krumscheid (2019). Central limit theorems for multilevel Monte Carlo methods. *J. Complexity* **54**, 101407, 16.

13. Hoel, Håkon and Anders Szepessy (2020). Classical Langevin dynamics derived from quantum mechanics. *Accepted for publication in Discrete Contin. Dyn. Syst. Ser. B.*

Preprints

1. Chernov, A., H. Hoel, K. J. H. Law, F. Nobile, and R. Tempone (Oct. 2017). Multilevel ensemble Kalman filtering for spatio-temporal processes. *ArXiv e-prints*. arXiv: 1710.07282 [math.NA].

2. Hoel, Håkon, Gaukhar Shaimerdenova, and Raul Tempone (2020). Multilevel Ensemble Kalman Filtering with local-level Kalman gains. *arXiv preprint arXiv:2002.00480*.

Conference and workshop presentations

➤ ENUMATH, Egmond aan Zee, Netherland, 2019. "Numerical methods for stochastic conservation laws".

➤ Annual meeting of the GAMM activity group on Modelling, Analysis and Simulation of Molecular Systems, Munich, 2019. "Langevin dynamics derived from heat bath dynamics".

➤ Workshop on SDEs/SPDEs: Theory, Numerics and their interplay with Data Science, Heraklion, Crete 2019. "Multilevel ensemble Kalman filtering algorithms".

➤ SIAM CSE19, Spokane, USA, 2019. "Multilevel ensemble Kalman filtering for spatio-temporal processes".

➤ 13th MCQMC, Rennes, France, 2018. "Multilevel ensemble Kalman filtering for spatio-temporal processes".

➤ Workshop on computational uncertainty quantification, Banff International Research Station, Canada, 2017. "Numerical methods for stochastic conservation laws"

➤ SciCADE17, Bath, England, 2017. "Multilevel ensemble Kalman filtering for spatio-temporal processes".

➤ SIAM Annual Meeting, Pittsburgh, USA, 2017. "Multilevel ensemble Kalman filtering for spatially extended models".

➤ NUMHYP17, Monte Verita, Switzerland, 2017. "Numerical methods for stochastic conservation laws".

➤ NASPDE16, Gothenburg, Sweden, 2016. "Numerical methods for stochastic conservation laws". (Invited speaker.)

➤ 11th International EnKF workshop, Ulvik, Norway, 2016. "Multilevel ensemble Kalman filtering".

➤ KAUST UQ Annual Winter Workshop, Thuwal, Saudi Arabia, 2016. "Multilevel ensemble Kalman filtering".

➤ SciCADE15, Potsdam, Germany, 2015. "Multilevel ensemble Kalman filtering".

➤ EquaDiff, Lyon, France, 2015. "Multilevel ensemble Kalman filtering".

➤ FoCM, Montevideo, Uruguay 2014. "Weak approximation of SDE by a mean square error adaptive multilevel Monte Carlo method".

➤ 11th MCQMC, Leuven, Belgium, 2014. "Weak approximation of SDE by a strong error adaptive multilevel Monte Carlo method".

➤ ENUMATH, Lausanne, Switzerland, 2014. "On non-asymptotic optimal stopping criteria in Monte Carlo simulations".

➤ Workshop on Stochastic Numerical Methods, Montevideo, Uruguay, 2012. "Two applications of the central limit theorem in numerical analysis".

➤ ICIAM, Vancouver, Canada, 2011. "How accurate is molecular dynamics?"

➤ Days on diffraction, St. Petersburg, Russia, 2011. "How accurate is molecular dynamics?"

➤ BIT, Lund, Sweden, 2010. "Gaussian coarse graining of a master equation generalization of Clarke's model".

➤ ENUMATH, Uppsala, Sweden, 2009. "Adaptive multilevel Monte Carlo simulation".