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🇳🇴 Norwegian (native), English (fluent), German (novice) and French (novice).



I am Head of the Mathematical Modeling group and associate professor (nor: førsteamanuensis) at Oslo Metropolitan University. My main research topic is scientific computing, and I focus on numerical simulation, developing efficient algorithms, and parallel computing. I have been teaching both small and large groups of students on bachelor, master and PhD level, and I also enjoy supervision of students. I have organized the Geilo Winter Schools in eScience for ten years, which attracted around 90 Ph.D.-level students every year on topics ranging from machine learning to scientific visualization and reproducible research.

## Key Metrics

**Career length:** 10 years since Ph.D. defense

**Supervision:** One PhD student, 14 master students, and 17 bachelor students (5 groups).

**Teaching:** Regularly since 2010. Consistently rated high ( 4.7 of 5) as a skilled lecturer. Taught Ph.D., master, bachelor and short courses for groups of ten to 300 students.

**Publications:** 1086 citations, h-index 11, i10-index 11. Twelve journal papers (plus two in preparation [O2, O4]). First/communicating author on one NSD level 2 [J8] and seven NSD level 1 [J1, J2, J3, J6, J9, J10, J11]. Nine conference papers. First/communicating author on four. Two technical reports (93 and 23 pages long).

**International network:** Two keynote and eight invited lectures. Reviewer for book, conferences, papers. Ph.D. committee member. External examiner for courses and master theses.

**Outreach:** Seven popular science articles/features and one TV appearance on Schrödingers katt (Norwegian Broadcasting Corporation). Over 200.000 views of youtube research videos.

**Research funding:** Eight projects as PI or co-PI ranging from small industrial projects to large research projects.

**Administrative experience:** Organized Geilo Winter School annually 2010 – 2020 with up-to 130 participants. Project leader for several industry and research projects.

## Employment history

**2019 – 2021:** Scientist, Norwegian Meteorological Institute, Research and development department, Division for climate modelling and air pollution.

**2017 – 2021:** Associate Professor\* (Førsteamanuensis), OsloMet - Oslo Metropolitan University.

**2010 – 2019:** Research scientist, Department of Mathematics and Cybernetics, SINTEF Digital.

**2013 – 2014:** Senior lecturer\* (Førstelektor), Department of Informatics, University of Oslo.

**2010 – 2013:** Associate professor\* (Førsteamanuensis), Norwegian School of Information Technology.

**2010 – 2010:** Visiting researcher, National Center for Computational Hydroscience and Engineering, USA.

**2007 – 2010:** Advisor\*, Department of Applied Mathematics, SINTEF ICT.

**2007 – 2007:** Developer\*, Norwegian Meteorological Institute.

\* Part time positions.

## Education

**2007 – 2010:** Ph.D. from the University of Oslo, Department of Informatics.

Title: Scientific Computing on Heterogeneous Architectures [O7].

Advisors: T. Dokken, K.-A. Lie, and K. M. Mørken.

**2002 – 2007:** M.Sc. from the University of Oslo, Department of Informatics.

Title: A MATLAB Interface to the GPU [O8].

Advisors: K.-A. Lie and T. Hagen.

## Organization of scientific meetings

- 2011 - 2020** Organizer of the Geilo Winter School in eScience since 2011. The school targets PhD-level students, but is open to the most brilliant bachelor and master students as well as experienced researchers. It attracts an average of 100 participants for each year, and topics have been Modern Techniques and Algorithms in HPC (2020, 53 participants, Joint with Torkel A. Haufmann, Øystein Klemetsdal, and Signe Riemer Sørensen); Learning from data (2019, 134 participants); Practical Artificial Intelligence (2018, 80 participants); Machine Learning, Deep Learning, and Data Analytics (2017, 127 participants); Scientific Visualization (2016, 53 participants); Uncertainty Quantification for Physical Phenomena (2015, 44 participants); Big Data Challenges to Modern Statistics (2014, 72 participants); Reproducible Research and Modern Scientific Software (2013, 42 participants); Introduction to Continuum Mechanics (2012, 35 participants, joint with Knut-Andreas Lie); Mathematical and Numerical Methods for Multiscale Problems (2011, 53 participants, joint with Knut-Andreas Lie).
- 2012:** Special session organizer together with Wen-Mei Hwu, “Advances in Heterogeneous Computing for Water Resources”, CMWR (Computational Methods in Water Resources), Univ. of Illinois at UC, USA.
- 2011:** Minisymposium organizer, “Shallow Water Simulations on Graphics Processing Units”, SIAM Conference on Mathematical & Computational Issues in the Geosciences, Long Beach, California, USA.

## Research funding

- 2017** OpenDrift - Optimization of drift trajectory code for parallel architectures (co-PI, Uninet SIGMA, NOK 0.2 M).
- 2016-2020** Geilo Winter School (PI, Research Council of Norway, NOK 1.7 M)
- 2016-2020** GPU Ocean (co-PI, Research Council of Norway, NOK 9 M)
- 2016** “GIS processing” (PI, industry client, NOK 0.3 M)
- 2013-2014** Simulators that write themselves (co-PI and PI, Strategic research project, SINTEF Digital, NOK 3 M)
- 2013** “Image and video processing” (PI, industry client, NOK 0.6 M)
- 2012** Iceberg Drift (PI at SINTEF, Statoil, NOK 0.4 M)
- 2011-2015** Evita Winter Schools (PI, Research Council of Norway, NOK 1.47 M)
- 2011-2015** Licensing of PhD code (PI, industry client, NOK 0.55 M)

## Commissions of trust

- 2017** Keynote speaker at Finite Volume for Complex Applications (FVCA8), Lille, France.
- 2014** Ph.D. committee member for thesis by Mattia Natali, “Sketch-based Modelling and Conceptual Visualization of Geomorphological Processes for Interactive Scientific Communication”, University of Bergen, Norway
- 2013** Reviewer, “The Cuda Handbook: A Comprehensive Guide to GPU Programming”, Nicholas Wilt, Addison-Wesley Professional
- 2013** International program committee member, 3rd International Workshop on New Algorithms and Programming Models for the Manycore Era (APMM 2013), Finland
- 2010** – External examiner for master theses at the Department of Mathematics and the Department of Informatics, University of Oslo, Norway.

## Teaching

- 2019: Algorithms and data structures (ITPE2300).** OsloMet - Oslo Metropolitan University. Around 230 students in their third semester. Developed new teaching material (code examples, lecture notes). Rated 4.7 of 5 as skilled communicator and lecturer in student evaluation.
- 2013 – 2019: Short course on GPU Computing.** University of Granada, Spain. Around 10-20 bachelor and master students annually.
- 2019: Short course on GPU programming.** The Norwegian Meteorological Institute. Around 25 researchers. Two full day courses (beginner and advanced). Rated 4.8 of 5 for quality of lectures.
- 2018: Short course on hyperbolic conservation laws on GPUs.** Politecnico di Milano. Around 30 master and PhD students from Politecnico di Milano and Marie Skłodowska-Curie Action exchange programs. 18 hours of lectures and tutorials prepared and held over three days.
- 2018: Algorithms and data structures (ITPE2300).** OsloMet - Oslo Metropolitan University. Around 200 students in their third semester. Developed new teaching material (code examples, lecture notes). Rated 4.85 of 5 as skilled communicator and lecturer in student evaluation.

- 2018: Differential equations and linear algebra (DAFE1000).** OsloMet - Oslo Metropolitan University. Around 80 students in their second semester. Assisted students with solving exercises and mandatory assignments during lab sessions.
- 2017: Multivariate calculus (DAVE3700).** OsloMet - Oslo Metropolitan University. Around 300 students in their fifth semester. Updated course to use new text book, and developed new teaching material (lecture notes, videos, solution guides). Rated 4.7 of 5 as skilled communicator and lecturer in student evaluation.
- 2017: Algorithms and data structures (ITPE2300).** OsloMet - Oslo Metropolitan University. 210 students in their third semester. Developed new teaching material (code examples, lecture notes). Rated 4.7 of 5 as skilled communicator and lecturer in student evaluation.
- 2017: Short course on GPU computing with Python.** University of Valladolid, Spain. Around 30 Ph.D. students.
- 2013 – 2014: Computer graphics and geometric modeling (INF3320).** University of Oslo. Around 30 students in their fifth semester. Updated course material (lecture notes).
- 2010 – 2013: Introduction to computer graphics (PG430).** Norwegian School of Information Technology. Roughly 20 students in their fourth semester. Developed completely new course (lecture notes, slides, mandatory assignments, etc.) based on existing curriculum description. Rated 5.4 of 6 in student surveys as skilled communicator and lecturer.
- 2010 – 2013: Advanced computer graphics (PG612).** Norwegian School of Information Technology. Roughly 20 students in their fifth semester. Developed completely new course (lecture notes, slides, mandatory assignments, etc.) based on existing curriculum description. Rated 5.2 of 6 in student surveys as skilled communicator and lecturer.

## Supervision

I have supervised the following students on bachelor, master, and PhD level.

- 2020: Håvard Heitlo Holm,** Massively parallel ensemble simulations with nonlinear data assimilation. PhD thesis at the Norwegian University of Science and Technology. Joint with Knut-Andreas Lie and Martin L. Sætra.
- 2018: Kristian Hasli Johnsen,** Domain Specific Languages for High-performance numerical simulation. Master thesis at the University of Oslo. Joint with Atgeirr Flø Rasmussen and Arne Jørgen Berre. **Erik Snartland,** Error resilience in distributed computing. Master thesis at the University of Oslo. **Aviral Bhandari,** A monitoring system for the Alto cloud system. Master thesis at the University of Oslo. **Skjalg Gustav Eriksen, Michael Dzhafarov Kardzhilov,** Air pollution in Oslo. Bachelor thesis at OsloMet - Oslo Metropolitan University. **Daniel Dysjeland, Kristine Helle, Knut Åge Hofseth and Espen Tønnessen Nordli,** Gamification of Yelpi.no. OsloMet - Oslo Metropolitan University. **Andreas Danielsen, Sondre Haldar-Iversen, Leif Niklas Lundberg and Aleksander Kløve Strengelsrud** 99X service desk app for smart phones. Bachelorthesis at OsloMet - Oslo Metropolitan University. **Andreas Stenseng Bjørnrud, Even Tsai Hansen, Sergio Jon Rye, Katarzyna Anna Zubowicz,** Photogram app for smart phones. Bachelorthesis at OsloMet - Oslo Metropolitan University. **Julie Katrine Høvik, Jesper Sannes Nyland, Trygve Nybakk Vang,** Sponsor app for smart phones (fadderordning). Bachelorthesis at OsloMet - Oslo Metropolitan University.
- 2017: Anders Voldsund,** A mathematical framework for computing river hydrographs based on high-resolution digital elevation models. Master thesis at the University of Oslo. Joint with Knut-Andreas Lie and Odd Andersen.
- 2015: Jens Kristoffer Reitan Markussen,** High-performance simulation on many-core computers. Master thesis at the University of Oslo. Joint with Knut-Andreas Lie and Xing Cai. **Guro Seternes,** A GPU simulator for geologic storage of CO<sub>2</sub> using vertical numeric integration, Master thesis at the Norwegian University of Science and Technology. Joint with Knut-Andreas Lie and Helge Holden.
- 2014 Tor Garman Nærland,** High resolution conservation laws on many-core computers. Master thesis at the University of Oslo. Joint with Knut-Andreas Lie and Knut M. Mørken. **Elisabeth Prestegård,** GPU accelerated simulation of CO<sub>2</sub> storage. Master thesis at the Norwegian University of Science and Technology. Joint with Halvor Møll Nilsen and Helge Holden. **Gard Skevik,** Auto-tuning flood simulations on CPUs and GPUs. Master thesis at the University of Oslo. Joint with Franz G. Fuchs and Martin Reimers. **Gorm Skevik,** Load-balancing techniques for multi-GPU flood simulations. Master thesis at the University of Oslo. Joint with Franz G. Fuchs and Martin Reimers. **André Amundsen,** Auto-tuning techniques for Flood Simulations on the GPU. Master thesis at the University of Oslo. Joint with Franz G. Fuchs and

Martin Reimers.

**2013: Espen Graff Berglie.** High-Order Schemes for the Shallow Water Equations on GPUs. Master thesis at the Norwegian University of Science and Technology. Joint with Knut-Andreas Lie and Helge Holden.

\* In progress.

## Journal Papers

- [J1] **A.R. Brodtkorb** and H.H. Holm. Coastal ocean forecasting on the GPU using a two-dimensional finite-volume scheme. *Tellus A: Dynamic Meteorology and Oceanography*, 2021.
- [J2] H.H. Holm, **A.R. Brodtkorb**, and M.L. Sætra. GPU computing with Python: Performance, energy efficiency and usability. *Computation*, 2020.
- [J3] **A.R. Brodtkorb**. Agile supervision of bachelor, master, and PhD theses. *Nordic Journal of STEM Education*, 3(1):246–249, 2019.
- [J4] H.H. Holm, **A.R. Brodtkorb**, G. Broström, K.H. Christensen, and M.L. Sætra. Evaluation of selected finite-difference and finite-volume approaches to rotational shallow-water flow. *Communications in Computational Physics*, 2019.
- [J5] M.L. Sætra, **A.R. Brodtkorb**, and K.-A. Lie. Efficient GPU-implementation of adaptive mesh refinement for the shallow-water equations. *Journal of Scientific Computing*, 2014.
- [J6] **A.R. Brodtkorb**, T.R. Hagen, C. Schulz, and G. Hasle. GPU computing in discrete optimization part i: Introduction to the GPU. *EURO Journal on Transportation and Logistics*, 2:129–157, 2013.
- [J7] C. Schulz, G. Hasle, **A.R. Brodtkorb**, and T.R. Hagen. GPU computing in discrete optimization part ii: Survey focused on routing problems. *EURO Journal on Transportation and Logistics*, 2:159–186, 2013.
- [J8] **A.R. Brodtkorb**, M.L. Sætra, and T.R. Hagen. GPU programming strategies and trends in GPU computing. *Journal of Parallel and Distributed Computing*, 73:4–13, 2012.
- [J9] **A.R. Brodtkorb**, T.R. Hagen, K.-A. Lie, and J. Natvig. Simulation and visualization of the Saint-Venant system using GPUs. *Computing and Visualization in Science*, 13(7):1–13, 2011.
- [J10] **A.R. Brodtkorb**, M.L. Sætra, and M. Altinakar. Efficient shallow water simulations on GPUs: Implementation, visualization, verification, and validation. *Computers & Fluids*, 55:1–12, 2011.
- [J11] **A.R. Brodtkorb**, C. Dyken, T.R. Hagen, J.M. Hjelmervik, and O. Storaasli. State-of-the-art in heterogeneous computing. *Scientific Programming*, 18(1):1 – 33, May 2010.
- [J12] **A.R. Brodtkorb**. An asynchronous API for numerical linear algebra. *Scalable Computing: Practice and Experience*, 9(3):153–163, 2008.

## Conference Papers

- [C1] H.H. Holm, M.L. Sætra, and **A.R. Brodtkorb**. Data assimilation for ocean drift trajectories using massive ensembles and gpus. In *Proceedings of Finite Volumes for Complex Applications IX*, 2020.
- [C2] H.H. Holm, **A.R. Brodtkorb**, and M.L. Sætra. Performance and energy efficiency of CUDA and OpenCL for GPU computing using Python. In *Proceedings of the ParCo 2019 conference*, 2019.
- [C3] **A.R. Brodtkorb**. Simplified ocean models the GPU. In *Norsk Informatikkonferanse*, 2018.
- [C4] T. Gierlinger, **A.R. Brodtkorb**, A. Stumpf, M. Weilera, and F. Michel. Visualization of marine sand dune displacements utilizing modern GPU techniques. In *The International Archives of the Photogrammetry, Remote Sensing and Spatial Information Sciences*, 2015.
- [C5] T.A. Haufmann, A. Berge, **A.R. Brodtkorb**, K. Kaspersen, and A. Kim. Real-time online camera synchronization for volume carving on GPU. In *IEEE International Conference on Advanced Video and Signal-Based Surveillance (AVSS)*, 2013.
- [C6] **A.R. Brodtkorb** and M.L. Sætra. Explicit shallow water simulations on GPUs: Guidelines and best practices. In *Proceedings of the XIX International Conference on Computational Methods for Water Resources*, 2012.
- [C7] M.L. Sætra and **A.R. Brodtkorb**. Shallow water simulations on multiple GPUs. In *Proceedings of the Para 2010 Conference*, pages 56–66, . Springer Berlin / Heidelberg, 2011.
- [C8] **A.R. Brodtkorb** and T.R. Hagen. A comparison of three commodity-level parallel architectures: Multi-core CPU, the Cell BE and the GPU. In *Mathematical Methods for Curves and Surfaces*, pages 70–80, . Springer Berlin / Heidelberg, February 2010.
- [C9] **A.R. Brodtkorb**. The graphics processor as a mathematical coprocessor in MATLAB. In *Complex, Intelligent and Software Intensive Systems, International Conference*, volume 0, pages 822–827, Los Alamitos, CA, USA, 2008. IEEE Computer Society.

## Other Publications

- [O1] **A.R. Brodtkorb**. metno/volcanicashinversion: v1.0.0-rc1. Technical report, May 2020.
- [O2] **A.R. Brodtkorb**. Solving hyperbolic conservation laws on GPUs with python, 2020.
- [O3] **A.R. Brodtkorb**, H. Fagerli, H. Klein, A. Mortier, A. Nyiri, A. Kylling, E. Sollum, S. Eckhardt, and T. Svendby. Varsling av vulkanaske i norsk luftrom. Technical report, The Norwegian Meteorological Institute and NILU, 2020.
- [O4] **A.R. Brodtkorb**, H. Klein, A. Kylling, A. Nyiri, A. Valdebenito, and A. Benedictow. Estimating volcanic ash emissions using satellite images with altitude observations, 2020. arXiv:2005.09942.
- [O5] A. Berge, **A.R. Brodtkorb**, T.A. Haufmann, K. Kaspersen, and A. Kim. Recommendations and guidelines for image processing on heterogeneous hardware. Technical report, EU FP7 project ADABTS, 2013.
- [O6] **A.R. Brodtkorb**, T.R. Hagen, and L.P. Røed. One-layer shallow water models on the GPU. Technical report 27, Norwegian Meteorological Institute Oslo, 2013.
- [O7] **A.R. Brodtkorb**. *Scientific Computing on Heterogeneous Architectures*. PhD thesis, University of Oslo, 2010. ISSN. 1501-7710, No. 1031.
- [O8] **A.R. Brodtkorb**. A MATLAB interface to the GPU. Master's thesis, University of Oslo, 2007.
- [O9] **A.R. Brodtkorb**, T. Fladby, and M.L. Sætra. PLU factorization on a cluster of GPUs using fast ethernet. Technical report, 2007. [technical report].
- [O10] **A.R. Brodtkorb**. Matrix-matrix multiplication in MATLAB using the GPU. Technical report, 2006. [technical report].