

Knud-Andreas Lie

Position: Chief Scientist / Research Manager
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Education

Dr. ing., Department of Mathematical Sciences, NTNU, Trondheim, 1998
Siv. ing., Department of Mathematical Sciences, NTH, Trondheim, 1993

Employment History

11/06– : **Chief scientist**/research manager, SINTEF, Dept. of Applied Mathematics
01/04–11/06: Senior scientist/research manager, SINTEF, Dept. of Applied Mathematics
01/00–12/03: Research director, SINTEF Applied Mathematics
09/99–12/99: Research scientist, SINTEF Applied Mathematics
01/15–12/20: **Professor II**, Department of Mathematical Sciences, NTNU, Trondheim
08/94–08/98: Doctoral student / teaching assistant, NTH/NTNU, Trondheim
09/07–12/14: Professor II in applied mathematics, University of Bergen
09/05–12/12: Senior scientist, Center of Mathematics for Applications, University of Oslo
09/99–08/05: Associate professor, Department of Informatics, University of Oslo
08/98–08/99: Postdoc, Department of Informatics, University of Oslo

Research Interests

Numerical solution of partial differential equations (PDEs)

- High-resolution, front-tracking, and level-set methods for hyperbolic equations
- Operator splitting methods

Flow and transport in porous media

- Gridding and discretizations on complex grids
- Multiscale methods, grid coarsening, and upscaling
- Open-source software (reproducible research)
- Nonlinear and linear solvers
- Flow diagnostics, streamline methods, etc.
- Geological storage of CO₂
- Fully implicit methods based on automatic differentiation
- Model-reduction methods, educated model simplifications, physics-based proxies

Heterogeneous computing (GPUs, etc) for nonlinear PDEs

Professional activities

Research management / academic offices:

- Leader of priority research area “Mathematics in Technology”, SINTEF Digital, 2020–present
- Board member, Gemini Center on Quantum Computing, 2020–present
- Research manager at Department of Mathematics & Cybernetics, SINTEF, 2006–present
- Program director, SIAM Activity Group on Geosciences, 2013–2014
- Research director, Department for Numerical Simulation, SINTEF, 2000–2003
- Faculty Board and Council, Physics and Mathematics, NTH, 1995–1996

Awards, memberships, etc:

- Fellow of the Society of Industrial and Applied Mathematics (SIAM), Class of 2020.
- A Peer Apart, Society of Petroleum Engineers, 2020.
- Norwegian Academy of Technological Sciences, elected 2014.
- Carl-Erik Frøberg Prize for Young Nordic Authors, 2000.
- Member of SIAM, EAGE, and SPE

Participation in research centers:

- Center for Integrated Operations in the Petroleum Industry (2007–2014)
- Center of Mathematics for Applications (Center of excellence, 2005–2012)
- Simula Research Laboratory (2001–2005)

Open-source software projects initiated and managed:

- MATLAB Reservoir Simulation Toolbox (MRST), <http://www.sintef.no/MRST>
Hundreds of users world-wide, 210 master and PhD theses, 570 papers authored externally
- Open Porous Media (OPM), <http://www.opm-project.org>. Used operationally by Equinor from 2021

Students (supervisor/co-supervisor):

- Master: 57 graduated (NTH/NTNU, UoA, UoB, UoO, TU Delft)
- Doctoral: 18 graduated (NTNU, UoB, UoO, CUPB)
- Postdocs: 10 candidates (SINTEF, NTNU)
- Long-term visiting PhD students: 10 previous (Sweden, Germany, China), 2 current (China)

Executive editor in *SPE Journal* (2015–2019, 2021): handled 1600+ scientific manuscripts

Organization of international conferences/workshops (past 10 years):

- ECCOMAS 2022: co-chair
- SPE: Open Subsurface (2021), Reservoir Simulation Symposium/Conference (2013–2021, co-chair 2023, chair 2025), Giant Oil and Gas Reservoirs (2014), Large Scale Computing (2012)
- Finite volumes for complex applications IX, Bergen: 2020
- Workshop I, Long Program on Computational Issues in Oil Field Applications, IPAM, UCLA: 2017
- Enumath: 2017
- SIAM Conference on Mathematical & Computational Issues in the Geosciences: 2009, 2011, 2015 (chair)
- InterPore Conference and Annual Meeting (advisory committee): 2010, 2011, 2012, 2014
- Geilo Winter Schools: 2001–present

Commissions of trust:

- SIAM Fellows Selection Committee (2021–present)
- 2023 SIAG/GS Early Career Prize, chair of the selection committee
- NT Review Board, Swedish Research Council (2015–2018)
- Advisory Board for Energi Simulation Chairs, Heriot-Watt University (2016–2022)
- Reviewer for grant applications: L’Agence Nationale de la Recherche (ANR), ERC Starting Grant, American Chemical Society, National Science Foundation (NSF), KAUST, Research Council of Norway
- Opponent on 8 doctoral and 1 licentiate theses (NTNU, UoB, Chalmers, Uppsala, DTU, Imperial College, TU Delft, Heriot Watt, Paris-Saclay).
- Evaluator for three senior lectureships (KTH: 2017, Uppsala: 2007, 2010), three professorship (Uppsala: 2015, Beijing: 2019, Heriot-Watt: 2019), one tenure track position (Tulsa: 2017)
- Evaluation of educational program “Computational Science and Engineering”, University of Oslo.

Teaching:

- Introductory course in numerical simulation and visualization, Univ. Oslo, 1998–2005.
- Geilo winter schools in computational mathematics, 35–90 participants, 2001–2011.
- Assistant teacher in mathematics/numerics, NTH/NTNU, 1991–1998.

Miscellaneous:

- Started the *Conservation Laws Preprint Server* in 1996. Maintained it until 2007.

Research grants

As research director/manager, I have been responsible for the annual acquisition of research projects funding a group of 6 to 20 people since 1999. Research contracts funded fully by industry are not listed to protect client confidentiality. The following list contains projects funded by the Research Council of Norway (RCN) (* = project manager, otherwise: principal investigator and co-author of proposal):

- Digital subsurface: Flow diagnostics and data-driven modeling in optimized reservoir management* (2018–2021). Petromaks2: 15.5 MNOK
- Preventing loss of near-well permeability in CO₂ injection wells (2018–2021). CLIMIT: 11.3 MNOK
- An intelligent brute force approach to predicting drift in the ocean (2016–2019). IKTPUS
- Controlled fracturing for increased recovery (2015–2019). Lundin, Petromaks2: 16.0 MNOK
- Simulation and optimization of aquifer-wide injection in the North Sea (2015–2017). Climit: 6.9 MNOK
- Full-field simulation of water-based EOR (2015–2017). Petromaks2: 6.3 MNOK
- Next generation multiscale methods for reservoir simulation (2013–2016). SLB, Petromaks2: 7.7 MNOK
- Simulation tools for CO₂ storage and CO₂-EOR (2013–2015). Statoil, Climit-demo: 12.4 MNOK.
- Upscaling of water-based EOR. VISTA (2012–2015): 2.0 MNOK
- International research training group NUPUS (2012–2015). Climit: 0.85 MNOK
- Flow diagnostics on stratigraphic and unstructured grids* (2012–2014). Chevron, Petromaks2: 3.44 MNOK
- Geological storage of CO₂: Mathematical modeling and risk assessment (MatMoRA-II, 2012–2015). Statoil, Climit: 20.4 MNOK
- eVITA Winter School 2011–2015*, eVITA. 1.5 MNOK
- A numerical CO₂ laboratory* (2010–2013). Statoil, Climit: 7.44 MNOK
- Development and analysis of vertically averaged models in porous media (2010–2013). Climit: 3.9 MNOK
- Impact of realistic geologic models on simulation of CO₂ storage (2010–2011). Roxar, Climit: 4.2 MNOK.
- GeoScale II: reservoir simulation on a geological scale* (2008–2010). Strategic institute program: 9.0 MNOK
- Heterogeneous computing - boosting performance of scientific and industrial computing by heterogeneous parallel architectures (2008–2010). Strategic institute program: 7.5 MNOK.
- Geological storage of CO₂: Mathematical modeling and risk assessment (2007–2010). StatoilHydro, Shell, Climit: 17.6 MNOK
- Nasjonal møteserie i eVitenskap (National arena in eScience)* (2007–2010). eVITA: 0.95 MNOK
- Multiscale simulation of highly heterogeneous and fractured reservoirs* (2006–2009). Shell, Petromaks: 8.97 MNOK
- Multiscale-streamline simulation of highly heterogeneous and fractured reservoirs (2006–2008). Schlumberger, Petromaks: 3.4 MNOK
- GeoScale: reservoir simulation on a geological scale* (2004–2007). Strategic institute program: 12.0 MNOK
- Graphic cards as a high-end computational resource (2004–2007). Strategic institute program: 13.0 MNOK
- Winter schools in computational mathematics* (2005–2006). BeMatA: 0.59 MNOK
- Winter schools in computational mathematics* (2001–2004). BeMatA: 0.68 MNOK.
- Streamline methods for automatic history-matching of production data* (2003–2006). Schlumberger, Petroforsk: 2.6 MNOK
- Pressure-based hybrid flux splitting schemes for compressible flows (2005–2007). BeMatA: 1.4 MNOK
- Nonlinear partial differential equations of evolution type-theory and numerics (2000–2003). BeMatA.

Publications

Most of my scientific papers are available at <http://folk.ntnu.no/andreas/>:

- **91** journal papers
- **81** proceedings papers, **11** peer-reviewed book chapters
- two monographs, four edited books, one strategic report
- two patents
- H-index: 44. Citations: 7116 (from scholar.google.com, Dec 2022)

Technical reports written at SINTEF for industry clients are not listed for confidentiality reasons.

In Journals:

- (1) K.-A. Lie and S. Krogstad. Comparison of two different types of reduced graph-based reservoir models: Interwell networks (GPSNet) versus aggregated coarse-grid networks (CGNet). *Journal of Petroleum Science and Engineering*, 2022, 111266. DOI: 10.1016/j.petrol.2022.111266.
- (2) G. P. Oliveira, T. N. E. Rodrigues, and K.-A. Lie. GAWPS: A MRST-based module for wellbore profiling and graphical analysis of flow units. *Advances in Geo-Energy Research*, 2021, 6(1): 38-53. DOI: 10.46690/ager.2022.01.04
- (3) F. Watson, S. Krogstad, and K.-A. Lie. The use of flow diagnostics to rank model ensembles. *Comput. Geosci.*, 2021. DOI: 10.1007/s10596-021-10087-6.
- (4) Ø. S. Klemetsdal, A. Moncorgé, H. M. Nilsen, O. Møyner, and K.-A. Lie. An adaptive sequential fully implicit domain-decomposition solver. *SPE J.*, 2021. DOI: 10.2118/203991-PA
- (5) S. Ma, B. Ju, L. Zhao, K.-A. Lie, Y. Dong, Q. Zhang, and Y. Tian. Embedded discrete fracture modelling: flow diagnostics, non-Darcy flow, and well placement optimization. *J. Petrol. Sci. Eng.*, 2021. DOI: 10.1016/j.petrol.2021.109477.
- (6) Ø. S. Klemetsdal, A. Moncorgé, O. Møyner, and K.-A. Lie. A numerical study of the additive Schwarz preconditioned exact Newton method (ASPEN) as a nonlinear preconditioner for immiscible and compositional porous media flow. *Comput. Geosci.*, 2021. DOI: 10.1007/s10596-021-10090-x
- (7) Ø. S. Klemetsdal, O. Møyner, A. Moncorgé, H. M. Nilsen, and K.-A. Lie. High-resolution compositional reservoir simulation with dynamic coarsening and local timestepping for unstructured grids. *SPE J.*, 2021. DOI: 10.2118/203982-PA
- (8) X. Raynaud, A. Pizzolato, A. Johansson, F. Caresani, A. Ferrari, O. Møyner, H. M. Nilsen, A. Cominelli, and K.-A. Lie. Toward accurate reservoir simulations on unstructured grids: design of simple error estimators and critical benchmarking of consistent discretization methods for practical implementation. *SPE J.*, 2021. DOI: 10.2118/203920-PA.
- (9) A. F. Rasmussen, T. H. Sandve, K. Bao, A. Lauser, J. Hove, B. Skaflestad, R. Klöfkorn, M. Blatt, A. B. Rustad, O. Sævareid, K.-A. Lie, A. Thune. The Open Porous Media Flow Reservoir Simulator. *Comput. Math. Appl.*, 2020. DOI: 10.1016/j.camwa.2020.05.014.
- (10) Ø. S. Klemetsdal and K.-A. Lie. Dynamic coarsening and local reordered nonlinear solvers for simulating transport in porous media. *SPE J.*, 2020. DOI: 10.2118/201089-PA.
- (11) G. Linga, O. Møyner, H.M. Nilsen, A. Moncorgé, and K.-A. Lie. An implicit local time-stepping method based on cell reordering for multiphase flow in porous media. *J. Comput. Phys.* X, 16 March 2020, 100051. DOI: 10.1016/j.jcp.2020.100051
- (12) Ø. S. Klemetsdal, A. F. Rasmussen, O. Møyner, and K.-A. Lie. Efficient reordered nonlinear Gauss-Seidel solvers with higher order for black-oil models. *Comput. Geosci.*, 24:595–607, 2020. DOI: 10.1007/s10596-019-09844-5
- (13) K.-A. Lie, T. S. Mykkeltvedt, and O. Møyner. A fully implicit WENO scheme on stratigraphic and unstructured polyhedral grids. *Comput. Geosci.*, 24:405–423, 2020. DOI: 10.1007/s10596-019-9829-x.
- (14) Ø. S. Klemetsdal, O. Møyner, and K.-A. Lie. Accelerating multiscale simulation of complex geomodels by use of dynamically adapted basis functions. *Comput. Geosci.*, 24:459–476, 2020. DOI: 10.1007/s10596-019-9827-z.
- (15) Ø. S. Klemetsdal, O. Møyner, and K.-A. Lie. Robust nonlinear Newton solver with adaptive interface-localized trust regions. *SPE J.*, 24(4):1576–1594, 2019. DOI: 10.2118/SPE-195682-PA
- (16) H. A. Marefat, M. A. Ashjari Aghdam, and K.-A. Lie. Preserving vorticity improves the accuracy of multiscale solvers. *J. Petrol. Sci. Eng.*, July 2019. DOI: 10.1016/j.petrol.2019.106231
- (17) R. L. Berge, Ø. S. Klemetsdal, and K.-A. Lie. Unstructured Voronoi grids conforming to lower-dimensional objects. *Comput. Geosci.*, 23(1):169–188, 2019. DOI: 10.1007/s10596-018-9790-0.
- (18) M. G. Zefreh, H. M. Nilsen, K.-A. Lie, X. Raynaud, and F. Doster. Streamline simulation of a reactive advective flow with discontinuous flux function. *Comput. Geosci.*, 23(2):255–271, 2019. DOI: 10.1007/s10596-018-9771-3.
- (19) R. Allen, H. M. Nilsen, K.-A. Lie, O. Møyner, and O. Andersen. Using simplified methods to explore the impact of parameter uncertainty on CO₂ storage estimates with application to the Norwegian Continental Shelf. *Int. J. Greenh. Gas Control*, 75:198–213, 2018. DOI: 10.1016/j.ijggc.2018.05.017
- (20) R. Allen, H. M. Nilsen, O. Andersen, and K.-A. Lie. Ranking and categorizing large-scale saline aquifer formations based on optimized CO₂ storage potentials and economic factors. *Int. J. Greenh. Gas Control*, 65:182–194, 2017. DOI: 10.1016/j.ijggc.2017.07.023
- (21) K.-A. Lie, O. Møyner, and J. R. Natvig. Use of multiple multiscale operators to accelerate simulation of complex geomodels. *SPE J.*, 22(6): , 2017. DOI: 10.2118/182701-PA
- (22) R. Allen, H.M. Nilsen, O. Andersen, and K.-A. Lie. Categorization of Norwegian Continental Shelf formations in terms of geological CO₂ storage potentials. *Energy Procedia*, 114:3476–3495, 2017. DOI: 10.1016/j.egypro.2017.03.1478
- (23) H.M. Nilsen, S. Krogstad, O. Andersen, R. Allen, and K.-A. Lie. Using sensitivities and vertical-equilibrium models for parameter estimation of CO₂ injection models with application to the Sleipner injection to measured data. *Energy Procedia*, 114:4583–4594, 2017. DOI: 10.1016/j.egypro.2017.03.1579

- (24) T. S. Mykkeltvedt, X. Raynaud, and K.-A. Lie. Fully implicit higher-order schemes applied to polymer flooding. *Comput. Geosci.*, 21(5–6):1245–1266, 2017. DOI: 10.1007/s10596-017-9676-6.
- (25) S. Krogstad, K.-A. Lie, H. M. Nilsen, C. F. Berg, and V. Kippe. Efficient flow diagnostics proxies for polymer flooding. *Comput. Geosci.*, 21(5–6):1203–1218, 2017. DOI: 10.1007/s10596-017-9681-9.
- (26) R. Allen, H. M. Nilsen, O. Andersen, and K.-A. Lie. On obtaining optimal well rates and placement for CO₂ storage. *Comput. Geosci.*, 21(5–6):1403–1422, 2017. DOI: 10.1007/s10596-017-9631-6.
- (27) K.-A. Lie, O. Møyner, J. R. Natvig, A. Kozlova, K. Bratvedt, S. Watanable, and Z. Li. Successful application of multiscale methods in a real reservoir simulator environment. *Comput. Geosci.*, 21(5–6):981–998, 2017. DOI: 10.1007/s10596-017-9627-2.
- (28) K. Bao, K.-A. Lie, O. Møyner, and M. Liu. Fully implicit simulation of polymer flooding with MRST. *Comput. Geosci.*, 21(5–6):1219–1244, 2017. DOI: 10.1007/s10596-017-9624-5.
- (29) O. Møyner and K.-A. Lie. A multiscale restriction-smoothed basis method for compressible black-oil models. *SPE J.*, 21(6):2079–2096, 2016. DOI: 0.2118/173265-PA.
- (30) S. Shah, O. Møyner, M. Tene, K.-A. Lie, and H. Hajibeygi. The multiscale restriction smoothed basis method for fractured porous media (F-MsRSB). *J. Comput. Phys.*, 318:36–57, 2016. DOI: 10.1016/j.jcp.2016.05.001.
- (31) S. T. Hilden, O. Møyner, K.-A. Lie, and K. Bao. Multiscale simulation of polymer flooding with shear effects. *Transp. Porous Media*, 113(1):111–135, 2016. DOI: 10.1007/s11242-016-0682-2.
- (32) X. Raynaud, K.-A. Lie, H. M. Nilsen, and A. Rasmussen. The single-cell transport problem for two-phase flow with polymer. *Comput. Geosci.*, 20(3):495–507, 2016. DOI: 10.1007/s10596-015-9502-y.
- (33) K.-A. Lie, H. M. Nilsen, O. Andersen, and O. Møyner. A simulation workflow for large-scale CO₂ storage in the Norwegian North Sea. *Comput. Geosci.*, 20(3):607–622, 2016. DOI: 10.1007/s10596-015-9487-6.
- (34) H. M. Nilsen, K.-A. Lie, and O. Andersen. Robust simulation of sharp-interface models for fast estimation of CO₂ trapping capacity in large-scale aquifer systems. *Comput. Geosci.*, 20(1):93–113, 2016. DOI: 10.1007/s10596-015-9549-9.
- (35) H. M. Nilsen, K.-A. Lie, and O. Andersen. Fully-implicit simulation of vertical-equilibrium models with hysteresis and capillary fringe. *Comput. Geosci.*, 20(1):49–67, 2016. DOI: 10.1007/s10596-015-9547-y.
- (36) O. Andersen, K.-A. Lie, and H. M. Nilsen. An open-source toolchain for simulation and optimization of aquifer-wide CO₂ storage. *Energy Procedia*, 86:324–333, 2016. DOI: 10.1016/j.egypro.2016.01.033.
- (37) O. Møyner and K.-A. Lie. A multiscale restriction-smoothed basis method for high contrast porous media represented on unstructured grids. *J. Comput. Phys.*, 304:46–71, 2016. DOI: 10.1016/j.jcp.2015.10.010.
- (38) H. M. Nilsen, K.-A. Lie, and O. Andersen. Analysis of CO₂ trapping capacities and long-term migration for geological formations in the Norwegian North Sea using MRST-co2lab. *Computers & Geoscience*, 79:15–26, 2015. DOI: 10.1016/j.cageo.2015.03.001.
- (39) H. M. Nilsen, K.-A. Lie, O. Møyner, and O. Andersen. Spill-point analysis and structural trapping capacity in saline aquifers using MRST-co2lab. *Computers & Geoscience*, 75:33–43, 2015. DOI: 10.1016/j.cageo.2014.11.002.
- (40) M. Pal, S. Lamine, K.-A. Lie, and S. Krogstad. Validation of the multiscale mixed finite-element method. *Int. J. Numer. Meth. Fluids*, 77(4):206–223, 2015. DOI: 10.1002/fld.3978.
- (41) S. Kaulmann, B. Flemisch, B. Haasdonk, K.-A. Lie, and M. Oehlberger. The localized reduced basis multiscale method for two-phase flows in porous media. *Int. J. Numer. Meth. Engng.*, 102(5):1018–1040, 2015. DOI: 10.1002/nme.4773.
- (42) O. Møyner, S. Krogstad, and K.-A. Lie. The application of flow diagnostics for reservoir management. *SPE J.*, 20(2): 306–323, 2015. DOI: 10.2118/171557-PA.
- (43) M. L. Sætra, A. R. Brodtkorb, and K.-A. Lie. Efficient GPU-implementation of adaptive mesh refinement for the shallow-water equations. *J. Sci. Comp.*, 63(1):23–48, 2015. DOI: 10.1007/s10915-014-9883-4.
- (44) K.-A. Lie, H. M. Nilsen, A. F. Rasmussen, and X. Raynaud. Fast simulation of polymer injection in heavy-oil reservoirs based on topological sorting and sequential splitting. *SPE J.*, 19(6):991–1004, 2014. DOI: 10.2118/163599-PA.
- (45) O. Møyner and K.-A. Lie. The multiscale finite-volume method on stratigraphic grids. *SPE J.*, 19(5):816–831, 2014. DOI: 10.2118/163649-PA.
- (46) O. Møyner and K.-A. Lie. A multiscale two-point flux-approximation method. *J. Comput. Phys.*, 275:273–293, 2014. DOI: 10.1016/j.jcp.2014.07.003.
- (47) K.-A. Lie, J. R. Natvig, S. Krogstad, Y. Yang, and X.-H. Wu. Grid adaptation for the Dirichlet-Neumann representation method and the multiscale mixed finite-element method. *Comput. Geosci.*, 18(3):357–372, 2014. DOI: 10.1007/s10596-013-9397-4.
- (48) F. O. Alpak, M. Pal, and K.-A. Lie. A multiscale method for modeling flow in stratigraphically complex reservoirs. *SPE J.*, 17(4):1056–1070, 2012. DOI: 10.2118/140403-PA.
- (49) H. M. Nilsen, A. R. Syversveen, K.-A. Lie, J. Tveranger, and J. M. Nordbotten. Impact of top-surface morphology on CO₂ storage capacity. *Int. J. Greenhouse Gas Control*, 11:221–235, 2012. DOI: 10.1016/j.ijggc.2012.08.012.

- (50) H. M. Nilsen, K.-A. Lie, and J. R. Natvig. Accurate modelling of faults by multipoint, mimetic, and mixed methods. *SPE J.*, 17(2):568–579, June 2012. DOI: 10.2118/149690-PA.
- (51) K.-A. Lie, J. R. Natvig, and H. M. Nilsen. Discussion of dynamics and operator splitting techniques for two-phase flow with gravity. *Int. J. Numer. Anal. Mod.* (Special issue in memory of Magne Espedal), 9(3):684–700, 2012.
- (52) K.-A. Lie, S. Krogstad, I. S. Ligaarden, J. R. Natvig, H. M. Nilsen, and B. Skaflestad. Open source MATLAB implementation of consistent discretisations on complex grids. *Comput. Geosci.*, 16(2):297–322, 2012, DOI: 10.1007/s10596-011-9244-4.
- (53) V. L. Hauge, K.-A. Lie, and J. R. Natvig. Flow-based coarsening for multiscale simulation of transport in porous media. *Comput. Geosci.*, 16(2):391–408, 2012. DOI: 10.1007/s10596-011-9230-x.
- (54) J. R. Natvig, B. Skaflestad, F. Bratvedt, K. Bratvedt, K.-A. Lie, V. Laptev, and S. K. Khataniar. Multiscale mimetic solvers for efficient streamline simulation of fractured reservoirs. *SPE J.*, 16(4):880–880, 2011. DOI: 10.2118/119132-PA.
- (55) M. Krotkiewski, I. Ligaarden, K.-A. Lie, D. W. Schmid. On the importance of the Stokes-Brinkman equations for computing effective permeability in carbonate karst reservoirs. *Comm. Comput. Phys.*, 10(5):1315–1332, 2011, DOI: 10.4208/cicp.290610.020211a.
- (56) H. M. Nilsen, P. A. Herrera, M. Ashraf, I. S. Ligaarden, M. Iding, C. Hermanrud, K.-A. Lie, J. M. Nordbotten, H. K. Dahle, and E. Keilegavlen. Field-case simulation of CO₂-plume migration using vertical-equilibrium models. *Energy Procedia*, 4:3801–3808, 2011. DOI: 10.1016/j.egypro.2011.02.315.
- (57) A. R. Brodtkorb, T. R. Hagen, K.-A. Lie, and J. R. Natvig. Simulation and visualization of the Saint-Venant system using GPUs. *Comput. Visual. Sci.* (Special issue on Hot Topics in Computational Engineering), 13(7):341–353, 2010. DOI: 10.1007/s00791-010-0149-x
- (58) A. F. Gulbransen, V. L. Hauge, and K.-A. Lie. A multiscale mixed finite-element method for vuggy and naturally-fractured reservoirs. *SPE J.*, 15(2):395–403, 2010. DOI: 10.2118/119104-PA.
- (59) B. Eikemo, K.-A. Lie, G.T. Eigestad, and H.K. Dahle. A discontinuous Galerkin method for advective transport in single-continuum models of fractured media. *Adv. Water Resour.*, 32(4):493–506, 2009. DOI: 10.1016/j.advwatres.2008.12.010.
- (60) V. R. Stenerud, K.-A. Lie, and V. Kippe. Generalized travel-time inversion on unstructured grids. *J. Pet. Sci. Eng.*, 65(3-4):175–187, 2009. DOI: 10.1016/j.petrol.2008.12.030
- (61) J. R. Natvig and K.-A. Lie. Fast computation of multiphase flow in porous media by implicit discontinuous Galerkin schemes with optimal ordering of elements. *J. Comput. Phys.*, 227(24):10108–10124, 2008. DOI: 10.1016/j.jcp.2008.08.024
- (62) V. R. Stenerud, V. Kippe, K.-A. Lie, and A. Datta-Gupta. Adaptive multiscale streamline simulation and inversion for high-resolution geomodels. *SPE J.*, 13(1):99–111, 2008. DOI: 10.2118/106228-PA
- (63) V. Kippe, J. E. Aarnes, and K.-A. Lie. A comparison of multiscale methods for elliptic problems in porous media flow. *Comput. Geosci.*, 12(3):377–398, 2008. DOI: 10.1007/s10596-007-9074-6.
- (64) J. E. Aarnes, S. Krogstad, and K.-A. Lie. Multiscale mixed/mimetic methods on corner-point grids. *Comput. Geosci.*, 12(3):297–315, 2008. DOI: 10.1007/s10596-007-9072-8.
- (65) R. Juanes and K.-A. Lie. Numerical modeling of multiphase first-contact miscible flows. Part 2. Front-tracking and streamline simulation. *Transp. Porous Media*, 72(1):97–120, 2008. DOI: 10.1007/s11242-007-9139-y
- (66) J. R. Natvig, K.-A. Lie, B. Eikemo, and I. Berre. An efficient discontinuous Galerkin method for advective transport in porous media. *Adv. Water Resour.*, 30(12):2424–2438, 2007. DOI: 10.1016/j.advwatres.2007.05.015.
- (67) R. Juanes and K.-A. Lie. Numerical modeling of multiphase first-contact miscible flows. Part 1. Analytical Riemann solver. *Transp. Porous Media*, 67(3):375–393, 2007. DOI: 10.1007/s11242-006-9031-1.
- (68) H. Hægland, H. K. Dahle, G. T. Eigestad, K.-A. Lie, and I. Aavatsmark. Improved streamlines and time-of-flight for streamline simulation on irregular grids. *Adv. Water Resour.*, 30(4):1027–1045, 2006. DOI: 10.1016/j.advwatres.2006.09.00.
- (69) V. R. Stenerud and K.-A. Lie. A multiscale streamline method for inversion of production data. *J. Pet. Sci. Eng.*, 54:79–92, 2006. DOI: 10.1016/j.petrol.2006.08.003.
- (70) J. E. Aarnes, S. Krogstad, and K.-A. Lie. A hierarchical multiscale method for two-phase flow based upon mixed finite elements and nonuniform coarse grids. *Multiscale Model. Simul.*, 5(2):337–363, 2006. DOI:10.1137/050634566
- (71) I. Berre, K. H. Karlsen, K.-A. Lie, and J. R. Natvig. Fast computation of arrival times in heterogeneous media. *Comput. Geosci.*, 9(4):179–201, 2005. DOI: 10.1007/s10596-005-9002-6
- (72) T. R. Hagen, J. M. Hjelmervik, K.-A. Lie, J. R. Natvig, and M. O. Henriksen. Visual simulation of shallow-water waves. *Simul. Model. Pract. Theory*, 13(8):716–726, 2005. DOI: 10.1016/j.simpat.2005.08.006
- (73) K.-A. Lie and R. Juanes. A front-tracking method for the simulation of three-phase flow in porous media. *Comput. Geosci.*, 9(1):29–59, 2005. DOI: 10.1007/s10596-005-5663-4
- (74) J. E. Aarnes, V. Kippe, and K.-A. Lie. Mixed multiscale finite elements and streamline methods for reservoir simulation of large geomodels. *Adv. Water Resour.*, 28(3):257–271, 2005. DOI: 10.1016/j.advwatres.2004.10.007
- (75) K.-A. Lie and S. Noelle. On the artificial compression method for second-order nonoscillatory central difference schemes for systems of conservation laws. *SIAM J. Sci. Comp.*, 24(4):1157–1174, 2003. DOI: 10.1137/S1064827501392880

- (76) K.-A. Lie and S. Noelle. An improved quadrature rule for the flux-computation in staggered central difference schemes in multidimensions. *J. Sci. Comp.*, 18(1):69–81, 2003. DOI: 10.1023/A:1020386111898
- (77) K. Hvistendahl Karlsen, K.-A. Lie, J. R. Natvig, H. F. Nordhaug, and H. K. Dahle. Operator splitting methods for systems of convection-diffusion equations: nonlinear error mechanisms and correction strategies. *J. Comput. Phys.*, 173(2):636–663, 2001. DOI: 10.1006/jcph.2001.6901
- (78) V. Haugse, K. Hvistendahl Karlsen, K.-A. Lie, and J. R. Natvig. Numerical solution of the polymer system by front tracking. *Transp. Porous Media*, 44(1):63–83, 2001. DOI: 10.1023/A:1010740024800
- (79) H. Holden, K. Hvistendahl Karlsen, and K.-A. Lie. Operator splitting methods for degenerate convection-diffusion equations I: convergence and entropy estimates. *CMS Conf. Proc.*, 129:293–316, 2000.
- (80) H. Holden, K. Hvistendahl Karlsen, and K.-A. Lie. Operator splitting methods for degenerate convection-diffusion equations II: numerical examples with emphasis on reservoir simulation and sedimentation. *Comput. Geosci.*, 4(2):185–206, 2000. DOI: 10.1023/A:1011582819188.
- (81) K. Hvistendahl Karlsen, K.-A. Lie, and N. H. Risebro. A fast marching method for reservoir simulation. *Comput. Geosci.*, 4(2):185–206, 2000. DOI: 10.1023/A:1011564017218
- (82) K.-A. Lie. Front tracking for one-dimensional quasilinear hyperbolic equations with variable coefficients. *Numer. Alg.*, 24(3):275–298, 2000.
- (83) R. Bürger, S. Evje, K. Hvistendahl Karlsen, and K.-A. Lie. Numerical methods for the simulation of the settling of flocculated suspensions. *Chem. Eng. J.*, 80:91–104, 2000.
- (84) S. Evje, K. Hvistendahl Karlsen, K.-A. Lie, and N. H. Risebro. Front tracking and operator splitting for nonlinear degenerate convection-diffusion equations. In “Parallel solution of partial differential equations”, P. Bjørstad and M. Luskin (Eds.), *IMA Vol. Math. Appl.*, 120:209–227, 2000.
- (85) K.-A. Lie. A dimensional splitting method for quasilinear hyperbolic equations with variable coefficients. *BIT*, 39(4):683–700, 1999.
- (86) R. Holdahl, H. Holden, and K.-A. Lie. Unconditionally stable splitting methods for the shallow water equations. *BIT*, 39(3):451–472, 1999.
- (87) K. Hvistendahl Karlsen and K.-A. Lie. An unconditionally stable splitting scheme for a class of nonlinear parabolic equations. *IMA J. Num. Anal.*, 39(3):451–472, 1999.
- (88) H. Holden, K.-A. Lie, and N. H. Risebro. An unconditionally stable method for the Euler equations. *J. Comp. Phys.*, 150(1):76–96, 1999.
- (89) K. Hvistendahl Karlsen, K.-A. Lie, N. H. Risebro, and J. Frøyen. A front-tracking approach to a two-phase fluid-flow model with capillary forces. *In Situ*, 22(1):59–89, 1998.
- (90) K. Hvistendahl Karlsen, K. Brusdal, H. K. Dahle, S. Evje, and K.-A. Lie. The corrected operator splitting approach applied to an advection–diffusion problem. *Comput. Methods Appl. Mech. Engrg.*, 167(3–4):239–260, 1998.
- (91) K.-A. Lie, V. Haugse and K. Hvistendahl Karlsen. Dimensional splitting with front tracking and adaptive local grid refinement. *Numer. Methods Partial Differential Equations*, 14(5):627–648, 1998.

Monographs and Edited Volumes:

- (92) K.-A. Lie and O. Møyner (eds.). Advanced modelling using the MATLAB Reservoir Simulation Toolbox (MRST). Cambridge University Press, 2021, ISBN 9781009019781, 572 pages.
- (93) K.-A. Lie. An introduction to reservoir simulation using MATLAB/GNU Octave: User guide for the MATLAB Reservoir Simulation Toolbox (MRST). Cambridge University Press, ISBN 9781108492430, 2019, 682 pages.
- (94) H. Holden, K.H. Karlsen, K.-A. Lie, and N.H. Risebro. *Splitting Methods for Partial Differential Equations with Rough Solutions: Analysis and Matlab Programs*. EMS Series of Lectures in Mathematics, Vol. 11, European Mathematical Society Publishing House, 2010.
- (95) E. Tjøland et al. *Computational Science and Engineering: Challenges and Opportunities Contributions Towards a Centre for Computational Science and Engineering at NTNU and SINTEF*. Norwegian University of Science and Technology, Trondheim, Norway, 2010.
- (96) X.-C. Tai, K. Mørken, M. Lysaker, and K.-A. Lie (eds.). *Scale Space and Variational Methods in Computer Vision. Second International Conference, SSVM 2009, Voss, Norway, June 1-5, 2009. Proceedings*. Lecture Notes in Computer Science, Vol 5567, Springer Verlag, 2009.
- (97) X.-C. Tai, K.-A. Lie, T. F. Chan, and S. Osher (eds.). *Image Processing Based on Partial Differential Equations*. Mathematics and Visualization, Springer Verlag, 2007.
- (98) G. Hasle, K.-A. Lie, and E. Quak (eds.). *Geometrical Modeling, Numerical Simulation, and Optimization: Industrial Mathematics at SINTEF*. Springer Verlag, 2007.

In Refereed Books and Proceedings:

- (99) R. L. Berge, Ø. S. Klemetsdal, and K.-A. Lie. Unstructured PEBI grids conforming to lower-dimensional objects. Chapter 1 in [92].
- (100) Ø. S. Klemetsdal and K.-A. Lie. Implicit discontinuous Galerkin methods for transport equations in porous media. Chapter 3 in [92].
- (101) K.-A. Lie and O. Møyner. Multiscale pressure solvers for stratigraphic and polytopal grids. Chapter 4 in [92].
- (102) X. Sun, K.-A. Lie, and K. Bao. Using state functions and MRST's AD-OO framework to implement simulators for chemical EOR. Chapter 7 in [92].
- (103) K.-A. Lie. On Holden's seven guidelines for scientific computing and development of open-source community software. In "Non-Linear Partial Differential Equations, Mathematical Physics, and Stochastic Analysis: The Helge Holden Anniversary Volume". Eds., F. Gesztesy et al., EMS Series of Congress Reports, pp. 389-422, 2018. DOI: 10.4171/186-1/17
- (104) K.-A. Lie and B. Mallison. Mathematical models for oil reservoir simulation. In "Encyclopedia of Applied and Computational Mathematics", Eds. B. Engquist, Springer-Verlag Berlin Heidelberg, pp. 850-856, 2015. DOI: 10.1007/978-3-540-70529-1.
- (105) K.-A. Lie. Hyperbolic conservation laws: computation. In "Encyclopedia of Applied and Computational Mathematics", Eds. B. Engquist, Springer-Verlag Berlin Heidelberg, pp. 662-665, 2015. DOI: 10.1007/978-3-540-70529-1.
- (106) J. E. Aarnes, K.-A. Lie, V. Kippe, and S. Krogstad. Multiscale methods for subsurface flow. In "Multiscale Modeling and Simulation in Science", Eds., B. Engquist, P. Lötstedt, and O. Runborg. LNCSE, Vol. 66, Springer Verlag, 2008, pp. 3-48.
- (107) S. Clausen, K. Greiner, O. Andersen, K.-A. Lie, H. Schulerud, and T. Kavli. Automatic segmentation of overlapping fish using shape priors. *Lecture Notes in Comput. Sci.*, Vol. 4522/2007, pp. 11-20, 2007. DOI: 10.1007/978-3-540-73040-8_2
- (108) T. R. Hagen, M. O. Henriksen, J. M. Hjelmervik, and K.-A. Lie. How to solve systems of conservation laws numerically using the graphics processor as a high-performance computational engine. In [98].
- (109) J. E. Aarnes, T. Gimse and K.-A. Lie. An introduction to the numerics of flow in porous media using Matlab. In [98].
- (110) J. E. Aarnes, V. Kippe, K.-A. Lie, and A. B. Rustad. Modelling of multiscale structures in flow simulations for petroleum reservoirs. In [98].
- (111) T. R. Hagen, K.-A. Lie, and J. R. Natvig. Solving the Euler equations on graphical processing units. *Lecture Notes in Comput. Sci.*, 3994:220-227, 2006.
- (112) J. E. Aarnes, V. Kippe and K.-A. Lie. Multiscale methods and streamline simulation for rapid reservoir performance prediction. In "Progress in Industrial Mathematics at ECMI 2004", Mathematics in Industry, Vol. 8, Eds., A. Di Bucchianico, R.M.M. Mattheij, and M.A. Peletier, Springer Verlag, 2006.
- (113) K.-A. Lie, S. Noelle, and W. Rosenbaum. On the resolution and stability of central difference schemes. In "Proceedings of the Third International Symposium on: Finite volumes for complex applications - problems and perspectives, Porquerolles (2002)", pp. 793-800, Hermes Penton Ltd, London, 2002.
- (114) K.-A. Lie and S. Noelle. High resolution nonoscillatory central difference schemes for the 2D Euler equations via artificial compression. In "Progress in Industrial Mathematics at ECMI 2000", Eds., M. Anile, V. Capasso, and A. Greco, Mathematics in Industry, Vol. 1, Springer Verlag, pp. 318-324, 2002.
- (115) H. Holden, K. Hvistendahl Karlsen, K.-A. Lie, and N. H. Risebro. Operator splitting for convection-dominated non-linear partial differential equations. In "Godunov Methods: Theory and Applications". Edited Review, E.F. Toro (Editor), Kluwer Academic/Plenum Publishers, pp. 469-475, 2001.
- (116) K. Hvistendahl Karlsen, K.-A. Lie, and N. H. Risebro. A front tracking method for conservation laws with boundary conditions. In "Hyperbolic problems: theory, numerics, applications (Seventh international conference in Zürich, 1998)", M. Fey and R. Jeltsch (eds.), *Int. Series of Numerical Mathematics*, Vol. 129, pp. 493-502, Birkhäuser, 1999.

Proceedings and Extended Abstracts:

- (117) S. Krogstad, O.S. Klemetsdal, K.-A. Lie. Efficient adaptation and calibration of adjoint-based reduced-order coarse-grid network models. SPE Reservoir Simulation Conference, Galveston, Texas, USA, 28-30 Mar 2023.
- (118) K.-A. Lie, O. Møyner, and Ø.A. Klemetsdal. An adaptive Newton-ASPEN solver for complex reservoir models. SPE Reservoir Simulation Conference, Galveston, Texas, USA, 28-30 Mar 2023.
- (119) H. Liu, X. Liao, K.-A. Lie, O.S. Klemetsdal, K. Bao, A. Johansson, X. Raynaud, and X. Zhao. An integrated modeling framework for simulating complex transient flow in fractured reservoirs by 3D high-quality unstructured mesh, SPE Reservoir Simulation Conference, Galveston, Texas, USA, 28-30 Mar 2023.
- (120) K.-A. Lie and S. Krogstad. Data-driven modelling with coarse-grid network models. ECMOR 2022 - European Conference on the Mathematics of Geological Reservoirs. DOI: 10.3997/2214-4609.202244065.

- (121) O. Møyner, A. Rasmussen, Ø. Klemetsdal, H. M. Nilsen, A. Moncorgé, and K.-A. Lie. Nonlinear domain decomposition preconditioning for robust and efficient field-scale simulation of subsurface flow. ECMOR 2022 - European Conference on the Mathematics of Geological Reservoirs. DOI: 10.3997/2214-4609.202244108.
- (122) M. A. Borregales Reverón, H. H. Holm, O. Møyner, S. Krogstad, and K.-A. Lie. Numerical comparison between ESMDA and gradient-based optimization for history matching of reduced reservoir models. SPE Reservoir Simulation Conference, Galveston, Texas, USA, 4–6 October 2021.
- (123) Ø. Klemetsdal, A. Moncorgé, O. Møyner, and K.-A. Lie. Additive Schwarz preconditioned exact Newton method as a nonlinear preconditioner for multiphase porous media flow. ECMOR XVII – 17th European Conference on the Mathematics of Oil Recovery, 2020. DOI: 10.3997/2214-4609.202035050
- (124) H.M. Nilsen, A. Moncorgé, K. Bao, O. Møyner, K.-A. Lie, and A. Brodtkorb. Comparison between algebraic multigrid and multilevel multiscale methods for reservoir simulation. ECMOR XVII – 17th European Conference on the Mathematics of Oil Recovery, 2020. DOI: 10.3997/2214-4609.202035063
- (125) F. Watson, S. Krogstad, K.-A. Lie. Flow diagnostics for model ensembles. ECMOR XVII – 17th European Conference on the Mathematics of Oil Recovery, 2020. DOI: 10.3997/2214-4609.202035133
- (126) M. Borregales, O. Møyner, S. Krogstad, K.-A. Lie. Data-driven models based on flow diagnostics. ECMOR XVII – 17th European Conference on the Mathematics of Oil Recovery, 2020. DOI: 10.3997/2214-4609.202035122
- (127) Ø.S. Klemetsdal, O. Møyner, X. Raynaud, K.-A. Lie. A comparison of consistent discretizations for elliptic problems on polyhedral grids. In: Klöforn R., Keilegavlen E., Radu F., Fuhrmann J. (eds): Finite Volumes for Complex Applications IX - Methods, Theoretical Aspects, Examples. FVCA 2020. Springer Proceedings in Mathematics & Statistics, vol 323. pp. 585-594, 2020, Springer, Cham. DOI: 10.1007/978-3-030-43651-3_55
- (128) Ø.S. Klemetsdal, O. Møyner, and K.-A. Lie. Implicit high-resolution compositional simulation with optimal ordering of unknowns and adaptive spatial refinement. SPE Reservoir Simulation Conference 10 - 11 Apr 2019, Galveston, Texas, USA
- (129) A. Guion, B. Skaflestad, K.-A. Lie, and X.-H. Wu. Validation of a non-uniform coarsening and upscaling framework. Reservoir Simulation Conference 10 - 11 Apr 2019, Galveston, Texas, USA
- (130) Ø.S. Klemetsdal, O. Møyner and K.-A. Lie. Use of dynamically adapted basis functions to accelerate multiscale simulation of complex geomodels. ECMOR XVI - 16th European Conference on the Mathematics of Oil Recovery, 2018. DOI: 10.3997/2214-4609.201802251.
- (131) K.A. Lie, T.S. Mykkeltvedt and O. Møyner. Fully implicit WENO schemes on stratigraphic and fully unstructured grids. ECMOR XVI - 16th European Conference on the Mathematics of Oil Recovery, 2018. DOI: 10.3997/2214-4609.201802269
- (132) Ø.S. Klemetsdal, A.F. Rasmussen, O. Møyner and K.-A. Lie. Nonlinear Gauss-Seidel solvers with higher order for black-oil models. ECMOR XVI - 16th European Conference on the Mathematics of Oil Recovery, 2018. DOI: 10.3997/2214-4609.201802130.
- (133) R. Toft, K.-A. Lie, Olav Møyner. Full approximation scheme for reservoir simulation. Norsk Informatikkonferanse, 2018.
- (134) Ø. Klemetsdal, O. Møyner, X. Raynaud, and K.-A. Lie. Non-linear Newton solver for a polymer two-phase system using interface-localized trust regions. IOR 2017 – 19th European Symposium on Improved Oil Recovery, 24–27 April, Stavanger, Norway
- (135) K.-A. Lie, O. Møyner, and J.R. Natvig. A feature-enriched multiscale method for simulating complex geomodels. SPE Reservoir Simulation Conference, Montgomery, Texas, USA, 20-22 February 2017.
- (136) Ø.S. Klemetsdal, R.L. Berge, K.-A. Lie, H.M. Nilsen, and O. Møyner. Unstructured gridding and consistent discretizations for reservoirs with faults and complex wells. SPE Reservoir Simulation Conference, Montgomery, Texas, USA, 20-22 February 2017.
- (137) K.-A. Lie, K. Kedia, B. Skaflestad, X. Wang, Y. Yang, X.-H. Wu, and N. Hoda. A General non-uniform coarsening and upscaling framework for reduced-order modeling. SPE Reservoir Simulation Conference, Montgomery, Texas, USA, 20-22 February 2017.
- (138) S. Krogstad, K.-A. Lie, H.M. Nilsen, C.F. Berg, and V. Kippe. Flow diagnostics for optimal polymer injection strategies. ECMOR XV, Amsterdam, Netherlands, 29 August – 1 September, 2016.
- (139) K.-A. Lie, O. Møyner, J.R. Natvig, A. Kozlova, K. Bratvedt, S. Watanabe, and Z. Li. Successful application of multiscale methods in a real reservoir simulator environment. ECMOR XV, Amsterdam, Netherlands, 2016.
- (140) K. Bao, K.-A. Lie, O. Møyner, and M. Liu. Fully implicit simulation of polymer flooding with MRST. ECMOR XV, Amsterdam, Netherlands, 29 August – 1 September, 2016.
- (141) R. Allen, H.M. Nilsen, O. Andersen, and K.-A. Lie. On obtaining optimal well rates and placement for CO2 storage. ECMOR XV, Amsterdam, Netherlands, 29 August – 1 September, 2016.
- (142) T. S. Mykkeltvedt, X. Raynaud, and K.-A. Lie. Fully-implicit higher-order schemes applied to polymer flooding. ECMOR XV, Amsterdam, Netherlands, 29 August – 1 September, 2016.

- (143) S. Krogstad, K.-A. Lie, O. Møyner, H. M. Nilsen, X. Raynaud, and B. Skaflestad. MRST-AD - an open-source framework for rapid prototyping and evaluation of reservoir simulation problems. 2015 Reservoir Simulation Symposium, Houston, Texas, USA, 23-25 February 2015. DOI: 10.2118/173317-MS
- (144) O. Møyner and K.-A. Lie. A multiscale method based on restriction-smoothed basis functions suitable for general grids in high contrast media. 2015 Reservoir Simulation Symposium, Houston, Texas, USA, 23-25 February 2015. DOI: 10.2118/173265-MS
- (145) K.-A. Lie, S. Krogstad, O. Møyner. Application of flow diagnostics and multiscale methods for reservoir management. 2015 Reservoir Simulation Symposium, Houston, Texas, USA, 23-25 February 2015. DOI: 10.2118/173336-MS
- (146) K.-A. Lie, H. M. Nilsen, and O. Andersen. A simulation workflow for large-scale CO₂ storage in the Norwegian North Sea. ECMOR XIV, Catania, Sicily, Italy, 8-11 September 2014. DOI: 10.3997/2214-4609.20141877
- (147) A. F. Rasmussen and K.-A. Lie. Discretization of flow diagnostics on stratigraphic and unstructured grids. ECMOR XIV, Catania, Sicily, Italy, 8-11 September 2014. DOI: 10.3997/2214-4609.20141844
- (148) X. Raynaud, K.-A. Lie, H. M. Nilsen, and A. F. Rasmussen. Well-posedness of the single-cell transport problem for a two-phase flow with polymer. ECMOR XIV, Catania, Sicily, Italy, 8-11 September 2014. DOI: 10.3997/2214-4609.20141893
- (149) O. Andersen, H. M. Nilsen, and K.-A. Lie. Reexamining CO₂ storage capacity and utilization of the Utsira Formation. ECMOR XIV, Catania, Sicily, Italy, 8-11 September 2014. DOI: 10.3997/2214-4609.20141809
- (150) T. S. Mykkeltvedt, I. Aavatsmark, K.-A. Lie. Numerical aspects of polymer flood modeling. ECMOR XIV, Catania, Sicily, Italy, 8-11 September 2014. DOI: 10.3997/2214-4609.20141852
- (151) S. T. Hilden, K.-A. Lie, X. Raynaud. Steady state upscaling of polymer flooding. ECMOR XIV, Catania, Sicily, Italy, 8-11 September 2014. DOI: 10.3997/2214-4609.20141802
- (152) K.-A. Lie, H. M. Nilsen, A. F. Rasmussen, and X. Raynaud. Fast simulation of polymer injection in heavy-oil reservoirs based on topological sorting and sequential splitting. 2013 SPE Reservoir Simulation Symposium, The Woodlands, Texas, USA, 18-20 February 2013. DOI: 10.2118/163599-MS
- (153) O. Møyner and K.-A. Lie. The multiscale finite volume method on unstructured grids. 2013 SPE Reservoir Simulation Symposium, The Woodlands, Texas, USA, 18-20 February 2013. DOI: 10.2118/163649-MS
- (154) M. Pal, S. Lamine, K.-A. Lie, and S. Krogstad. Multiscale method for simulating two and three-phase flow in porous media. 2013 SPE Reservoir Simulation Symposium, The Woodlands, Texas, USA, 18-20 February 2013. DOI: 10.2118/163669-MS
- (155) K.-A. Lie, H. M. Nilsen, A. F. Rasmussen, and X. Raynaud. An unconditionally stable splitting method using reordering for simulating polymer injection. Proceedings of ECMOR XIII, Biarritz, France, 10-13 September 2012. DOI: 10.3997/2214-4609.20143229
- (156) J. R. Natvig, K.-A. Lie, S. Krogstad, Y. Yang, and X.-H. Wu. Grid adaption for upscaling and multiscale methods. Proceedings of ECMOR XIII, Biarritz, France, 10-13 September 2012. DOI: 10.3997/2214-4609.20143191
- (157) S. Krogstad, K.-A. Lie, and B. Skaflestad. Mixed multiscale methods for compressible flow. Proceedings of ECMOR XIII, Biarritz, France, 10-13 September 2012. DOI: 10.3997/2214-4609.20143240
- (158) M. Pal, S. Lamine, K.-A. Lie, and S. Krogstad. Multiscale methods for two and three-phase flow simulation in subsurface petroleum reservoirs. Proceedings of ECMOR XIII, Biarritz, France, 10-13 September 2012. DOI: 10.3997/2214-4609.20143227
- (159) A. R. Syversveen, H. M. Nilsen, K.-A. Lie, J. Tveranger, and P. Abrahamsen. A study on how top-surface morphology influences the CO₂ storage capacity. Proceedings of the Ninth International Geostatistics Congress, Oslo, Norway, June 11-15, 2012. Springer Verlag. DOI: 10.1007/978-94-007-4153-9_39
- (160) J. Tveranger, P. Dahle, H.M. Nilsen, A.R. Syversveen, J.M. Nordbotten, P. Abrahamsen, and K.A. Lie. Impact of top-reservoir morphology on CO₂ sequestration. Third EAGE CO₂ Geological Storage Workshop Understanding the Behaviour of CO₂ in Geologic Storage Reservoirs 26-27 March 2012, Edinburgh, UK. DOI: 10.3997/2214-4609.20143799
- (161) K.M. Flornes, K.-A. Lie, H.M. Nilsen, O. Saevareid, and B. Flemisch. An open source numerical CO₂ laboratory. Third EAGE CO₂ Geological Storage Workshop Understanding the Behaviour of CO₂ in Geologic Storage Reservoirs 26-27 March 2012, Edinburgh, UK. DOI: 10.3997/2214-4609.20143808
- (162) F. O. Alpak, M. Pal, and K.-A. Lie. A multiscale method for modeling flow in stratigraphically complex reservoirs. 2011 SPE Reservoir Simulation Symposium, The Woodlands, Texas, USA, 21-23 February 2011. DOI: 10.2118/140403-MS
- (163) K.-A. Lie, S. Krogstad, I. S. Ligaarden, J. R. Natvig, H. M. Nilsen, and B. Skaflestad. Discretisation on complex grids - Open-source MATLAB implementation. Proceedings of ECMOR XII, Oxford, UK, 6-9 September 2010. DOI: 10.3997/2214-4609.20145007
- (164) V. L. Hauge, K.-A. Lie, and J. R. Natvig. Flow-based grid coarsening for transport simulations. Proceedings of ECMOR XII, Oxford, UK, 6-9 September 2010. DOI: 10.3997/2214-4609.20145016

- (165) K.-A. Lie, I. S. Ligaarden, and H. M. Nilsen. Accurate discretization of vertically-averaged models of CO₂ plume migration. Proceedings of ECMOR XII, Oxford, UK, 6-9 September 2010. DOI: 10.3997/2214-4609.20144940
- (166) I. Ligaarden, M. Krokiewski, K.-A. Lie, D. W. Schmid, M. Pal. On the Stokes-Brinkman equations for modeling flow in carbonate reservoirs. Proceedings of ECMOR XII, Oxford, UK, 6-9 September 2010. DOI: 10.3997/2214-4609.20144924
- (167) M. Ashraf, K.-A. Lie, H. M. Nilsen, and A. Skorstad. Impact of geological heterogeneity on early-stage CO₂ plume migration: sensitivity study. Proceedings of ECMOR XII, Oxford, UK, 6-9 September 2010. DOI: 10.3997/2214-4609.20145012
- (168) M. Ashraf, K.-A. Lie, H.M. Nilsen, J.M. Nordbotten and A. Skorstad. Impact of heterogeneity on early-stage CO₂ plume migration. XVIII International Conference on Water Resources (CMWR 2010), J. Carrera (Ed), CIMNE, Barcelona, 2010.
- (169) S. Krogstad, K.-A. Lie, H. M. Nilsen, J. R. Natvig, B. Skaflestad, and J.E. Aarnes. A multiscale mixed finite-element solver for three-phase black-oil flow. 2009 SPE Reservoir Simulation Symposium, The Woodlands, Texas, USA, 2-4 February. DOI: 10.2118/118993-MS
- (170) A. F. Gulbransen, V. L. Hauge, and K.-A. Lie. A multiscale mixed finite-element method for vuggy and naturally-fractured reservoirs. 2009 SPE Reservoir Simulation Symposium, The Woodlands, Texas, USA, 2-4 February. DOI: 10.2118/119104-MS
- (171) H. M. Nilsen and K.-A. Lie. Front-tracking methods for use in streamline simulation of compressible flow. 2009 SPE Reservoir Simulation Symposium, The Woodlands, Texas, USA, 2-4 February. DOI: 10.2118/119099-MS
- (172) J. R. Natvig, B. Skaflestad, F. Bratvedt, K. Bratvedt, K.-A. Lie, V. Laptev, and S. K. Khataniar. Multiscale mimetic solvers for efficient streamline simulation of fractured reservoirs. 2009 SPE Reservoir Simulation Symposium, The Woodlands, Texas, USA, 2-4 February. DOI: 10.2118/119132-MS
- (173) A. F. Gulbransen, V. L. Hauge, and K.-A. Lie. A multiscale mixed finite-element method for vuggy and naturally-fractured reservoirs. 21 Nordic Seminar on Computational Mechanics. T. Kvamsdal, K.M. Mathisen, and B. Pettersen (eds), CIMNE, Barcelona, 2008.
- (174) J. R. Natvig and K.-A. Lie. On efficient implicit upwind schemes. Proceedings of ECMOR XI, Bergen, Norway, 8-11 September 2008. DOI: 10.3997/2214-4609.20146356
- (175) K.-A. Lie, V. R. Stenerud, and A. F. Rasmussen. Adaptive multiscale-streamline simulation and inversion for high-resolution geomodels. Proceedings of ECMOR XI, Bergen, Norway, 8-11 September 2008. DOI: 10.3997/2214-4609.20146408
- (176) H. M. Nilsen and K.-A. Lie. On front tracking for compressible flow. Proceedings of ECMOR XI, Bergen, Norway, 8-11 September 2008. DOI: 10.3997/2214-4609.20146367
- (177) V. L. Hauge, J. E. Aarnes, and K.-A. Lie. Operator splitting of advection and diffusion on non-uniformly coarsened grids. Proceedings of ECMOR XI, Bergen, Norway, 8-11 September 2008. DOI: 10.3997/2214-4609.20146392
- (178) V. Kippe, H. Hægland, and K.-A. Lie. A method to improve the mass-balance in streamline methods. 2007 SPE Reservoir Simulation Symposium, Houston, Texas U.S.A., February 26-28, 2007. DOI: 10.2118/106250-MS
- (179) V. R. Stenerud, V. Kippe, A. Datta-Gupta, and K.-A. Lie. Adaptive multiscale streamline simulation and inversion for high-resolution geomodels. 2007 SPE Reservoir Simulation Symposium, Houston, Texas U.S.A., February 26-28, 2007. DOI: 10.2118/106228-MS
- (180) J. E. Aarnes, S. Krogstad, K.-A. Lie, and J. R. Natvig. Fast sequential implicit porous media flow simulations using multiscale finite elements and reordering of cells for solution of nonlinear transport equation. Proceedings of ECMOR X, Amsterdam, the Netherlands, 4-7 September 2006. DOI: 10.3997/2214-4609.201402519
- (181) B. Eikemo, I. Berre, H. K. Dahle, K.-A. Lie, and J. R. Natvig. A discontinuous Galerkin method for computing time-of-flight in fractured media. CMWR XVI – Computational Methods in Water Resources. Copenhagen, Denmark, June, 2006.
- (182) H. Hægland, H. K. Dahle, K.-A. Lie, and G.T. Eigestad. Adaptive streamline tracing for streamline simulation on irregular grids. CMWR XVI – Computational Methods in Water Resources. Copenhagen, Denmark, June, 2006.
- (183) V. Kippe, J.E. Aarnes, and K.-A. Lie. Multiscale finite-element methods for elliptic problems in porous media flow. CMWR XVI – Computational Methods in Water Resources. Copenhagen, Denmark, June, 2006.
- (184) J.R. Natvig, K.-A. Lie, and B. Eikemo. Fast solvers for flow in porous media based on discontinuous Galerkin methods and optimal reordering. CMWR XVI – Computational Methods in Water Resources. Copenhagen, Denmark, June, 2006.
- (185) K.-A. Lie, J. E. Aarnes, V. Kippe, and S. Krogstad. Multiscale methods for flow in porous media. Rakenteiden Mekaniikka (J. Structural Mechanics), Vol. 38, No. 3, pp. 19–25, 2005. (Special issue for the 18th Nordic Seminar on Computational Mechanics, October 27–30, 2005.)
- (186) R. Juanes and K.-A. Lie. A front-tracking method for efficient simulation of miscible gas injection processes. 2005 SPE Reservoir Simulation Symposium, Houston, Texas U.S.A., 31 January 2005–2 February 2005. DOI: 10.2118/93298-MS

- (187) R. Juanes, K.-A. Lie, and V. Kippe. A front-tracking method for hyperbolic three-phase models. Proceedings of ECMOR IX, Cannes, France, 30 August–2 September. 2004.
- (188) J. E. Aarnes and K.-A. Lie. Toward reservoir simulation on geological grid models. Proceedings of ECMOR IX, Cannes, France, 30 August–2 September. 2004.
- (189) I. Berre, H. K. Dahle, K. Hvistendahl Karlsen, K.-A. Lie, and J. R. Natvig. Time-of-flight + fast marching + transport collapse: an alternative to streamlines for two-phase porous media flow with capillary forces? In "Proceedings of the XIV International Conference on Computational Methods in Water Resources", pp. 995–102, Elsevier, 2002.
- (190) K. Hvistendahl Karlsen, K.-A. Lie, J. R. Natvig, and N. H. Risebro. A fast marching method for 3D reservoir simulation. In "Proceedings of the 13th Nordic Seminar on Computational Mechanics (NSCM-13)", Eds., J. Hellesland, H. Osnes, and G. Skeie, pp. 147–150, Mechanics and Applied Mathematics Series, No. 7, University of Oslo, Norway, October 2000.

Popular science papers:

- (191) K.-A. Lie. Multiscale methods for subsurface flow. In [95], pp. 60–63.

Theses:

- (192) V. Haugse and K.-A. Lie. Numerical solution of boundary value problems using probabilistic methods. Master's thesis. Department of Mathematical Sciences, Norwegian Institute of Technology (NTH), 1993.
- (193) K.-A. Lie. Front tracking and operator splitting for convection dominated problems. NTNU Trondheim, Dr. Ing. thesis 1998:44, Department of Mathematical Sciences.

Patents / Patent applications:

- (194) O. Møyner, K.-A. Lie, and J.R. Natvig. Adaptive multiscale multi-fidelity reservoir simulation. US10534877B2
- (195) T. Dokken, M. Ofstad Henriksen, J.E. Aarnes, and K.-A. Lie. Avbildning av geologisk responsdata med strømme-prosessorer. Patent number: 329011. (Geological Response Data Imaging With Stream Processors, United States Patent Application 20090164756.).