

Kundan Kumar, PhD

Associate Professor,
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Date of Birth: June 10, 1983
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Education and Work Experience

Current Affiliations

Associate Professor (tenured), Porous Media Group, Department of Mathematics, University of Bergen, Norway, Feb 2020 –.

Senior Lecturer, Department of Mathematics, Karlstad University, Sweden, 2018 – 2020.

Associate Professor II, Porous Media Group, Department of Mathematics, University of Bergen, Norway, 2018 – 2020..

Previous work experiences

Associate Professor, Porous Media Group, Department of Mathematics, University of Bergen, Norway, Oct 2014 — Sep 2018 (4 Year Fixed Position).

Postdoctoral Researcher, Center for Subsurface Modeling, ICES, UT Austin, Nov 2012 — Sep 2014
Supervisor: Prof. Dr. Dr. h.c. mult. Mary F Wheeler

Scientist B, Defense Research Development Laboratory, Hyderabad, DRDO, Aug 2005 — Aug 2006.

Fellowships and Awards

1. **2017 Lauritz Meltzer Prize for Young Researcher**, Bergen, Norway (Awarded every year to two young researchers at the University of Bergen by the L. Meltzer Foundation for *outstanding scientific contributions*. The recipients are selected across *all the disciplines and faculties*).
2. **2017 SIAM/Geosciences Early Career Prize** for *outstanding contributions to numerical analysis and computational methods for complex flow and transport in porous media* (Awarded *once* every two years to a young scientist by the SIAM Geosciences Activity group).
3. **Vista fellowship**, The Norwegian Academy of Science and Letters, 2014 (declined due to taking Associate Professorship position at The University of Bergen, Norway).
4. Selected for **Heidelberg Laureate Forum fellowship** (meeting of young researchers with Fields, Abel and Turing Laureates), Heidelberg, Germany, Sep 2013.
5. **Nominated** for the **best PhD thesis award** at TU/e 2013, **Several travel grants** including Akademia grants, Meltzer travel grant, US Junior Oberwolfach Fellow, SIAM Early Career Travel Grant, Jyväskylä Summer School Scholarship, NUPUS Travel Grant Award.
6. **Erasmus Mundus Scholarship** sponsored by European Commission for Masters in Industrial Mathematics, 2006 – 2008.

7. **Kesar Devi Scholarship** by Kesar Devi Trust, **Jawahar Gajree Scholarship** by Jawahar Gajree Trust, IIT Delhi, 2003 – 05.

Education

PhD (cum laude*) in **Applied Mathematics**, Eindhoven University of Technology, Sep 2012.
Supervisors: Prof. Dr. Sorin Pop and Prof. Dr. Mark A Peletier

Thesis title: Upscaling of Reactive Flows

* cum laude is the highest possible grade for PhD in The Netherlands and is awarded to approximately 5 percent of the graduating PhD candidates.

M.Sc.* (cum laude) in **Industrial Mathematics**, Eindhoven University of Technology, The Netherlands, 2008.

M.Sc.* (sehr gut) in **Technomathematik**, specialisation in Partial Differential Equations, University of Kaiserslautern (TU), Germany, 2008.

Thesis title: On Computational Analysis of Multiphase Flow in a PEM Fuel Cell

ITWM Fraunhofer, Kaiserslautern, Germany.

Supervisor: Prof. Dr. Oleg Iliev.

* I have been enrolled in a double-degree MSc program between the two universities

B.Tech. in **Mechanical Engineering**, Indian Institute of Technology, Delhi, 2005.

Teaching Experience and Supervision

Karlstad University, Department of Mathematics

Lecturer for Ordinary Differential Equations, Fall 2018

Lecturer for Advanced Linear Algebra, Spring 2019

Lecturer for Complex Analysis and Transforms, Spring 2019

University of Bergen, Department of Mathematics

Lecturer for Finite Element Analysis, Fall 2015, Fall 2017

Lecturer for Computational Science II, Spring 2015, Spring 2016*, Spring 2017, Spring 2018

Lecturer for Vector and Tensor Analysis, Fall 2016

* The number of students doubled in the class, feedback score 4.6 on a scale of 5.

Teaching at Eindhoven University of Technology, The Netherlands

Instructor, Advanced Calculus 2008-09, 2009-10, 2010-11.

Instructor, Vector Calculus 2009-2010.

Course Assistant, Variational and Topological Methods in PDEs, 2010-11.

Supervision: Master and PhD students

Currently (co-)supervising 6 PhD theses, 1 PhD as main, and have already supervised 5 masters theses and 1 Bachelor thesis.

PhD students: Graduated

1. Leonid Vassilev, *thesis topic: Generalized Continuum Model for description of fluid transport in porous networks*, **Co-supervisor, with Jan Nordbotten and Florin Radu (main supervisor)**
2. Manuel Borregales, *thesis topic: Iterative solvers for coupled flow and geomechanics models*, **Co-supervisor, supervisor: Florin Radu**
3. David L. Marban, *Co-supervisor, thesis topic: Modeling and simulation for microbial enhanced oil recovery*, **Co-supervisor, supervisor: Florin Radu**

PhD students: In Progress

1. Ingeborg Gjerde, *thesis topic: Coupling free flow and porous media for non-isothermal processes for subsurface energy storage applications*, **Supervisor**
2. Martin Dugstad, *thesis topic: Upscaling of Pore Scale Processes for Polymer Enhanced Oil Recovery*, **Co-supervisor, Supervisor: Arne Skauge**
3. Jakub Both, *thesis topic: Solvers for coupled, non-linear, unsaturated flow and geomechanics models*, **Co-supervisor, supervisor: Florin Radu**
4. Abay Kassa, *thesis topic: Modeling and simulations for CO₂-Hydrocarbon interactions for CO₂ storage with enhanced recovery*, **Co-supervisor, supervisor: Sarah Gasda**

Research Grants (in NOK, 1 Eur \approx 9.3 NOK)

I have been involved as PI or co-PI in several grant proposals, totaling over 8 Million Eur. As co-PI, I have contributed in writing part of the proposals, responsible for some of the work packages, and as supervisor or co-supervisor for PhD students involved.

1. Project Manager and PI, Upscaling of Evolving Microstructures and its Applications, *NRC-Daad collaboration with University of Erlangen, Germany* (**80k NOK**).
2. Project Manager and PI, An extensive collaborative project on education, research and training with Russian Academy of Sciences, St Petersburg, Russia, *SIU project, CPRU 2015/10040* (**147k NOK**).
3. Co-applicant (**Project Manager for University of Bergen part, 6.3M NOK**), EOR upscaling - from lab to field, *Petromaks 2* (**24M NOK**).
4. Co-applicant, Thermo-Mechanical Subsurface Energy Storage, *Toppforsk* (**25M NOK**), Role: PhD supervisor, Work package leader.
5. Co-applicant, Efficient models for Microbially Induced CALcite Precipitation as a seal for CO₂ storage (MICAP), (**8M NOK**), Role: PhD co-supervisor, Work package leader.
6. Co-applicant, Improving microbial selective plugging technology through experimentally based modelling and simulation, *Petromaks 2* (**9M NOK**), Role: PhD co-supervisor.
7. Co-applicant, Fundamentals of CO₂-Hydrocarbon Interactions for CO₂ storage with enhanced recovery (EOR/EGR) in offshore reservoirs: modeling, numerical methods and upscaling (Project CHI), *Klimaforsk* (**8M NOK**), Role: PhD co-supervisor, Work package leader.

8. Co-applicant, Efficient discretizations and fast solvers for poroelasticity, *NRC-DAAD collaboration with Helmut-Schmidt-Universität, Germany (60k NOK)*, Role: Collaborator.
9. Co-author, Experimentally based modelling of colloid transport in multiphase porous media (EPOCH), *Statoil - Akademia Grant (\approx 3400k NOK)*, Role: Collaborator.

Research

My research interests are in developing **upscaled models and computational tools** for **coupled multiphysics processes such as flow and transport** in complex media involving multiple scales such as porous media. The reactive flow models lead to changes in the geometry at the pore scale modelled by a free boundary coupled with flow and transport equations. I have performed upscaling of such reactive processes and developed numerical methods for solving the upscaled models. I have also worked on advanced computational algorithms such as **domain decomposition techniques** for simulating multiphase flow and transport problems. In addition, I have been developing and analysing **iterative and multirate algorithms** for solving the **coupled flow and geomechanics** problems in complex media involving thin features such as **fractures**.

I have published more than 50 articles and proceedings. Many of my articles are in top journals including SIAM and IMA journals. I have also been editor of a book containing the proceedings of the ENUMATH conference 2017 that I was one of the main organisers. ENUMATH conference is one of the largest and top conferences in numerical and computational mathematics in Europe.

Editor

F. A. Radu, **K. Kumar**, I. Berre, J. Nordbotten, S. Pop, Numerical mathematics and advanced applications—ENUMATH 2017, Lect. Notes Comput. Sci. Eng., Springer (to appear).

Publications

No. of publications: In journals: 37, Submitted: 4, Book chapters/proceedings: 18

Submitted

1. I. Gjerde, **K. Kumar**, J. Nordbotten, A Mixed Approach to the Poisson Problem with Line Sources, **Submitted to SIAM Journal on Numerical Analysis**.
2. J. Both, **K. Kumar**, J. Nordbotten, F. A. Radu, The gradient flow structures of thermo-poro-visco-elastic processes in porous media. **Submitted to Archive for Rational Mechanics and Analysis** (also arXiv: arXiv:1907.03134), 2019.
3. M. Borregales, **K. Kumar**, J.M. Nordbotten, F. Radu, Iterative solvers for Biot model under small and large deformation, **submitted to Computational Geosciences**, 2019.
4. **K. Kumar**, S. Matculevich, J. Nordbotten, S. Repin, Guaranteed and computable bounds of approximation errors for the Biot problem, **submitted to CAMWA**.

Journal articles

5. D. Marban, **K. Kumar**, G. Bodtker, I. S. Pop, F. A. Radu, An upscaled model for permeable biofilm in a thin channel and tube, **accepted in Transport in Porous Media** <https://doi.org/10.1007/s11242-020-01381-5>, 2020.
6. **K. Kumar**, F. List, I. S. Pop, F. A. Radu, Formal upscaling and numerical validation of fractured flow models for Richards' equation, **accepted in Journal of Computational Physics**.

7. R. Ye, **K. Kumar**, M. V. de Hoop, M. Campillo, A multi-rate iterative coupling scheme for dynamic ruptures and seismic waves generation in the self-gravitating Earth: the discontinuous Galerkin method, **accepted in Journal of Computational Physics**.
8. R. Ye, **K. Kumar**, M. V. de Hoop, Analysis of dynamic ruptures generating seismic waves in a self-gravitating planet: an iterative coupling scheme and well-posedness, **accepted in Quarterly of Applied Mathematics** (AMS Journal).
9. F. List, **K. Kumar**, I. S. Pop, F. A. Radu, Rigorous upscaling of unsaturated flow in fractured porous media, **SIAM Journal on Mathematical Analysis**, 52(1), 239–276, 2020.
10. I. Gjerde, **K. Kumar**, J. Nordbotten, A Singularity Removal Method for Coupled 1D-3D Flow Models, **accepted in Computational Geosciences**, 2019.
11. T. Almani, A. Manea, **K. Kumar**, A. Dogru, Convergence of the undrained split iterative scheme for coupling flow with geomechanics in heterogeneous poroelastic media, **accepted in Computational Geosciences** <https://doi.org/10.1007/s10596-019-09860-5>.
12. E. Storvik, J. Both, **K. Kumar**, J. Nordbotten, F. A. Radu, On the optimization of the fixed-stress splitting for Biot's equations, **accepted in International Journal for Numerical Methods in Engineering** <https://doi.org/10.1002/nme.6130>.
13. I. Gjerde, **K. Kumar**, J. Nordbotten, B. Wohlmuth, Splitting method for elliptic equations with line sources, **accepted, ESAIM: Mathematical Modelling and Numerical Analysis**, 53 (5), 1715–1739, 2019.
14. T. Almani, **K. Kumar**, M. F. Wheeler, Stability of multirate explicit coupling of geomechanics with flow in a poroelastic medium, **Computers & Mathematics with Applications**, 78 (8), 2019, 2682–2699.
15. D. L. Marban, N. Liu, I. S. Pop, **K. Kumar**, P. Pettersson, G. Bodtke, T. Skauge, F. A. Radu, A pore-scale model for permeable biofilm: numerical simulations and laboratory experiments, **Transport in Porous Media**, 2019, 127 (3), 643–660.
16. M. A. Endo Kokubun, F. A. Radu, E. Keilegavlen, **K. Kumar**, K. Spildo, Transport of polymer particles in a oil-water flow in porous media: enhancing oil recovery, **Transport in Porous Media**, 2019, 126 (2), 501–519.
17. M. Borregales, F. Gaspar, **K. Kumar**, F. A. Radu, C. Rodrigo, A parallel-in-time fixed-stress splitting method for Biot's consolidation model. **Computers & Mathematics with Applications**, 77, 2019, 1466–1478.
18. J. Both, **K. Kumar**, J. M. Nordbotten, F. A. Radu, Anderson accelerated fixed-stress splitting schemes for consolidation of unsaturated porous media. **Computers & Mathematics with Applications**, 77, 2019, 1479–1502.
19. M. Borregales, F. Radu, **K. Kumar**, J.M. Nordbotten, Robust iterative schemes for non-linear poromechanics, **Computational Geosciences**, 22 (4), 1021–1038.
20. V. Girault, M. F. Wheeler, **K. Kumar**, G. Singh, Mixed formulation of a linearized lubrication fracture model in a poro-elastic medium, **Springer-ECCOMAS series Computational Methods in Applied Sciences**, 171–219, 47, Springer, Cham.
21. C. Bringedal, **K. Kumar**, Effective behavior near clogging in upscaled equations for non-isothermal reactive porous media flow, **Transport in Porous Media**, 120(3), 2017, 553–577.

22. L. Vassiliev, **K. Kumar**, F. Radu, and J.M. Nordbotten, On the properties of the parameter space of generalized continuum transport model for description of fluid flow in porous networks. **Transport in Porous Media**, 119(3), 2017, 673–688.
23. A. Salama, M. F. El-Amin, **K. Kumar**, S. Sun, Flow and transport in tight and shale formations: A review. **Geofluids**, 2017, 4251209.
24. T. Almani, **K. Kumar**, M. F. Wheeler, Convergence and Error Analysis of Fully Discrete Iterative Coupling Schemes for Coupling Flow with Geomechanics, **Computational Geosciences**, 21, 5–6, 2017, 1157–1172.
25. F. Radu, **K. Kumar**, J.M. Nordbotten, I.S. Pop, A convergent mass conservative numerical scheme based on mixed finite elements for two-phase flow in porous media, **IMA Journal of Numerical Analysis**, 2017, doi: 10.1093/imanum/drx032.
26. J. Both, M. Borregales, **K. Kumar**, J. M. Nordbotten, F. A. Radu, Optimal iterative coupling for Biot’s equations, **Applied Mathematics Letters**, 68, 2017, 101–108.
27. **K. Kumar**, I. S. Pop, M. Neuss-Radu, Homogenization of a pore scale model for precipitation and dissolution in porous media, **IMA Journal of Applied Mathematics**, 2016, 81, 1–21.
28. T. Almani, **K. Kumar**, A. Dogru, G. Singh, M. F. Wheeler, Convergence Analysis of Multirate Fixed-Stress Split Iterative Schemes for Coupling Flow with Geomechanics, **Computer Methods for Applied Mechanics and Engineering**, 311, 2016, 180–207.
29. **K. Kumar**, V. Girault, M. F. Wheeler, Convergence of iterative coupling of geomechanics with flow in a fractured poroelastic medium, **Computational Geosciences**, 2016, 20, 997–1011.
30. I. S. Pop, J. Bogers, **K. Kumar**, Analysis and upscaling of a reactive transport model in fractured porous media involving nonlinear transmission condition, **Vietnam Journal of Mathematics, invited paper in honour of Willi Jäger**, 2016, 45, 77–102.
31. F. A. Radu, J.M. Nordbotten, I. S. Pop, **K. Kumar**, A robust linearization scheme for finite volume based discretizations for simulation of two-phase flow in porous media, **Journal of Computational and Applied Mathematics**, 2015, 289, 134–141.
32. B. Ganis, **K. Kumar**, G. Pencheva, M. F. Wheeler, I. Yotov, A Global Jacobian Method for mortar discretizations of a fully-implicit two-phase flow model,” **SIAM Multiscale Modeling and Simulation**, 2014, 12-4, 1401–1423.
33. **K. Kumar**, M. van Helvoort, I. S. Pop, Rigorous upscaling of rough boundaries for reactive flows, **Journal of Applied Mathematics and Mechanics(ZAMM)**, 2014, 94, 624–644.
34. **K. Kumar**, I. S. Pop, F. A. Radu, Convergence analysis for a conformal discretization of a model for precipitation and dissolution in porous media, **Numerische Mathematik**, 2014, 127, 715–749.
35. **K. Kumar**, M. Pisarenco, M. Rudnaya, V. Savcenco, A note on analysis and numerics of algae growth, **Nonlinear analysis: Real world applications**, 2014, 15, 392–403.
36. **K. Kumar**, T. L. van Noorden, I. S. Pop, Upscaling of reactive flows in domains with moving oscillating boundaries, **Discrete and Continuous Dynamical Systems, Series S**, 2014, 7(1), 95–111.
37. **K. Kumar**, T. Wick, M. F. Wheeler, Reactive flow in a thin channel and reaction-induced boundary movement in a monolithic ALE framework, **SIAM Journal on Scientific Computing**, 2013, 6, B1235–B1266.

38. **K. Kumar**, I. S. Pop, F. A. Radu, Convergence analysis of mixed numerical schemes for reactive flow in a porous medium, **SIAM Journal on Numerical Analysis**, 2013, 51(4), 2283–2308.
39. J. Bogers, **K. Kumar**, P. H. L. Notten, J. F. M. Oudenhoven, I. S. Pop, A multiscale domain decomposition approach for chemical vapor deposition, **Journal of Computational and Applied Mathematics**, 2013, 246, 65–73.
40. **K. Kumar**, T. L. van Noorden, I. S. Pop, Effective dispersion equations for reactive flows involving free boundaries at the microscale, **SIAM Multiscale Modeling and Simulation**, 2011, 9(1), 29–58.
41. **K. Kumar**, M. Pisarenco, M. Rudnaya, V. Savacenco, S. Srivastava, Reconstruction of 3D morphology from optical sectioning of biological objects, **Mathematics-in-Industry Case Studies**, 2011, 3, 19–36.

Book chapters and conference proceeding

42. T. Almani, A. Manea, **K. Kumar**, Convergence And Error Analysis Of The Undrained-Split Iterative Coupling Scheme In Heterogeneous Poro-Elastic Media, **ECMOR XVI-16th European Conference on the Mathematics of Oil Recovery**, 2018, DOI: 10.3997/2214-4609.201802261.
43. I. Gjerde, **K. Kumar**, J. Nordbotten, Well modelling by means of coupled 1d-3d flow models, **ECMOR XVI-16th European Conference on the Mathematics of Oil Recovery**, 2018, DOI: 10.3997/2214-4609.201802117.
44. T. Almani, **K. Kumar**, M. F. Wheeler, The Global Inexact Newton Method as a Nonlinear Solver Framework in Multirate Iteratively Coupled Flow and Geomechanics Problems, **GEO Conference Proceedings**, 2018.
45. J. Both, **K. Kumar**, J. M. Nordbotten, I. S. Pop, F. A. Radu, Linear iterative schemes for doubly degenerate parabolic equations, **Numerical Mathematics and Advanced Applications**, *Proceedings of the ENUMATH 2017*, accepted.
46. D. Marban, **K. Kumar**, I. S. Pop, F. A. Radu, Numerical simulation of biofilm formation in a microchannel, **Numerical Mathematics and Advanced Applications**, *Proceedings of the ENUMATH 2017*, accepted.
47. J. Both, **K. Kumar**, J. M. Nordbotten, F. A. Radu, Iterative Methods for Coupled Flow and Geomechanics in Unsaturated Porous Media, *Proceedings on Sixth Biot Conference on Poromechanics July 2017*, Paris, France. <https://doi.org/10.1061/9780784480779.050>.
48. T. Almani, **K. Kumar**, M. F. Wheeler, Error Analysis for Multirate Schemes in Porous Media, *ECMOR Conference Proceeding*, In **ECMOR XV. 15th European Conference on the Mathematics of Oil Recovery**, Amsterdam, 2016.
49. T. Almani, A. Dogru, **K. Kumar**, G. Singh, M. F. Wheeler, Convergence of multirate iterative coupling of geomechanics with flow in a poroelastic medium, **Saudi Aramco Journal of Technology**, Spring 2016.
50. T. Almani, **K. Kumar**, G. Singh, M. F. Wheeler, Multirate undrained splitting for coupled flow and geomechanics in porous media, **Numerical Mathematics and Advanced Applications**, *Proceedings of the ENUMATH 2015*, 431–440.
51. G. Singh, T. Wick, M.F. Wheeler, G. Pencheva, **K. Kumar**; Coupled Flow and Geomechanics Modeling for Fractured Poroelastic Reservoirs, **SPE Hydraulic Fracturing Technology Conference**, 2015.

52. N. Sepasian, **K. Kumar**, M. Breeuwer, A geometrical approach to find corresponding patches in 3D medical surfaces, **Lecture Notes in Computer Science**, 2015, 9370, 217–219.
53. B. Ganis, **K. Kumar**, G. Pencheva, M.F. Wheeler, I. Yotov, A multiscale mortar method and two-stage preconditioner for multiphase flow using a global Jacobian approach, SPE Large Scale Computing and Big Data Challenges in Reservoir Simulation Conference, 2014, **SPE 172990-MS**.
54. **K. Kumar**, V. Girault, T. Almani, M. F. Wheeler, Convergence of iterative schemes for coupled flow and geomechanics in a fractured reservoir, **Oberwolfach workshop** on Reactive Flows in Deformable Complex Media, *Oberwolfach Report*, 2014.
55. **K. Kumar**, T. van Noorden, M. F. Wheeler, T. Wick, An ALE-based method for reaction-induced boundary movement towards clogging, **Numerical Mathematics and Advanced Applications**, *Proceedings of the ENUMATH 2013*, A. Abdulle, S. Deparis, D. Kressner, F. Nobile, M. Picasso (Eds.), Springer-Verlag Heidelberg, 2014, 633–641.
56. **K. Kumar**, I. S. Pop, F. A. Radu, Numerical analysis for an upscaled model for dissolution and precipitation in porous media, **Numerical Mathematics and Advanced Applications**, *Proceedings of the ENUMATH 2011*, A. Cangiani, R.L. Davidchack, E. Georgoulis, A.N. Gorban, J. Levesley, M.V. Tretyakov (Eds.), Springer-Verlag Heidelberg, 2013, 703–711.
57. N. Bansal, et al., Optimization of lifetime in sensor networks, **Proceedings of the 84th European Study Group Mathematics with Industry**, Eindhoven, The Netherlands, Jan 2012.
58. A. Thornton et al. Modeling and optimization of algae growth, **Proceedings of the 72nd European Study Group Mathematics with Industry**, Amsterdam, The Netherlands, Jan 2010.
59. F. van Beckum, J. B. van den Berg, S. Boettcher, M. de Gee, **K. Kumar**, J. van Opheusden, Stiffening while drying, **Proceedings of the 67th European Study Group Mathematics with Industry**, Wageningen, The Netherlands, Jan 2009.

Preprints

60. T. Almani, **K. Kumar**, M. F. Wheeler, Multirate Undrained Splitting for Coupled Flow and Geomechanics in Porous Media, **ICES Report 16-13**, The Institute for Computational Engineering and Sciences, The University of Texas at Austin, May 2016.
61. T. Almani, **K. Kumar**, G. Singh, M. F. Wheeler, Stability of Multirate Explicit Coupling of Geomechanics with Flow in a Poroelastic Medium, **ICES Report 16-12**, The Institute for Computational Engineering and Sciences, The University of Texas at Austin, May 2016.

Collaborations

My main external collaborations are with University of Bergen (F. Radu, J. Nordbotten), Center for Integrated Petroleum Research, Bergen, Norway (S. Gasda, A. Skauge), Hasselt University, Belgium (I. S. Pop), University of Texas at Austin, USA (M. F. Wheeler, T. Arbogast), University of Pittsburgh, USA (I. Yotov), University of Erlangen-Nurmburg, Germany (N. Ray, R. Schulz, P. Knabner), Heidelberg University, Germany (W. Jaeger), University of Zaragoza, Spain (F. Gaspar, C. Rodrigo), and University of Jyväskylä, Finland (S. Repin). From Industrial side, my collaborators are T. Almani (Saudi Aramco) and T. L van Noorden (COMSOL BV, The Netherlands).

Selected Talks at International Conferences and Seminars

I have given more than 40 talks at conferences and workshops. I have given more than 15 departmental seminars/colloquia at several universities around the world including Heidelberg, Kaiserslautern, Pittsburgh, New Delhi, Cambridge, Nottingham, Heriot-Watt, Eindhoven, Austin, IIT Mumbai, TIFR Bangalore, IISc Bangalore, IIT Patna, KTH Stockholm, and Stuttgart.

Some selected talks are:

1. **Plenary prize lecture in SIAM Geosciences 2017, Erlangen, Germany.**
2. **Solution strategies for coupled flow and geomechanics in porous media**, Shell Rijsvijk, The Netherlands, Mar 2018.
3. **Coupled problems in porous media**, Indian Institute of Technology, Patna, Feb 2017.
4. **Splitting methods for coupled flow and geomechanics problems**, University of Nottingham, Nottingham, April 2016.
5. **Iterative methods for coupled flow and geomechanics**, Isaac Newton Institute of Mathematical Sciences, Cambridge, April 2016.
6. **Mixed method for a reactive flow model involving precipitation-dissolution processes**, European Numerical Mathematics and Advanced Applications, **Enumath**, Sep 14–18, 2015, Ankara.
7. **Homogenization of a precipitation-dissolution model in a porous medium**, SIAM Conference on Control and its Applications, Jul 8–10, 2015, Paris, France.
8. **Multirate methods for coupled flow and geomechanics for a fractured poroelastic medium**, 7th International Conference on Porous Media, **Interpore**, May 18–22, 2015, Padova, Italy.
9. **Iterative method for coupled flow and geomechanics for a fractured poroelastic medium**, Workshop on Reactive Flows in Deformable, Complex Media, Sept. 21-27, 2014, Oberwolfach, Germany.
10. **Coupled flow and geomechanics for a fractured porelastic medium**, **SPE** Large Scale Computing and Big Data Challenges in Reservoir Simulation Conference and Exhibition, September 15-17, 2014, Istanbul, Turkey.

Professional Activities

Served in 2 Masters thesis defence committees, 3 PhD defence committees including one at University of Texas at Austin and at Technical University of Munich, 2 PhD defence lecture committees.

Organizer: Conferences

1. **Member, Scientific Committee**, ENUMATH Conference 2019, Egmond aan Zee, The Netherlands.
2. **Member, International Scientific Committee**, fifth ECCOMAS Young Investigators Conference (YIC 2019), Barcelona (Spain).
3. **Local organizing committee, Enumath Conference**, Sep 2017, Bergen (with P. Bjørstad, I. Berre, H. Dahle, H. Munthe-Kaas, and F. Radu).

Organizer: Workshops

1. **Interpore Kick-off workshop on Porous media research in Norway; Theory, experiments, models, and applications**, Sep 23, 2016, Bergen (with Sarah Gasda).
2. **Workshop on A posteriori error estimates for poroelasticity**, 7–9 Mar, 2016, Bergen, Norway (with Florin Radu and Sergey Repin).
3. **Workshop on Flow in Deformable Porous Media**, Nov 23–25, 2015, Zaragoza, Spain (with Florin Radu, Francisco Gaspar, and Carmen Rodrigo).
4. **Workshop on Robust discretizations for elasticity and poroelasticity**, 16–18 Feb, 2015, Finse, Norway (with Mats Larson and Jan Nordbotten).

Organizer: Minisymposia

1. **Minisymposium on Pore scale formulations and upscaling of reactive transport problems in porous media**, 10th International Conference on Porous Media, **Interpore**, 14–17 May, 2018, New Orleans, USA (with Carina Bringedal and Jyoti Phirani).
2. **Minisymposium on Limit Processes in Porous Media**, SIAM Geosciences, 11 Sep – 14 Sep, 2017, Erlangen, Germany.
3. **Minisymposium on Robust techniques for the simulation of poromechanics** **Interpore**, 8 May – 11 May, 2017, Rotterdam, The Netherlands (with Florin Radu).
4. **Minisymposium on Advanced Discretization Methods for Multiphase Flows**, **Interpore**, 9 May– 12 May, 2016, Cincinnati, Ohio, USA (with Gergina Pencheva and Mary F Wheeler).
5. **Minisymposium on Recent developments in mixed and DG methods**, ENUMATH, 14–18 Sep, 2015, Ankara, Turkey (with Markus Bause).
6. **Minisymposium on Advanced Discretization Methods for Complex Multiphysics Applications in Porous Media**, SIAM Geosciences, 29 June– 2 July, 2015, Stanford, USA (with Gergina Pencheva and Mary F Wheeler).
7. **Minisymposium on Fractured Porous Media: Deformation and Crack Development**, SIAM Geosciences, 29 June–2nd July, 2015, Stanford, USA (with Inga Berre).
8. **Minisymposium on Computational challenges in simulating reactive flows in deformable porous media**, 7th International Conference on Porous Media, **Interpore**, 18–21 May 2015, Padova, Italy (with Florin Radu and Sorin Pop).
9. **Minisymposium on Reactive flow, geomechanics and compositional models in porous media**, 6th International Conference on Porous Media, **Interpore**, 27–30 May 2014, Milwaukee, USA (with B. Ganis, G. Pencheva, T. Wick, and M. F. Wheeler).
10. **Minisymposium on Multiscale methods for multiphase flows**, 6th International Conference on Porous Media, **Interpore**, 27–30 May 2014, Milwaukee, USA (with B. Ganis, G. Pencheva, and M. F. Wheeler).

Guest editor, Flow and Transport in Porous Media: A Multiscale Focus, GEOFLUIDS**Reviewer for more than 15 leading journals in mathematics and applications related to porous media flow**

Numerische Mathematik, SIAM Journal of Numerical Analysis, SIAM Journal on Scientific Computing, Networks and Heterogeneous Media, Computer Methods in Applied Mechanics and Engineering, Computational Geosciences, Water Resources Research, European Journal of Applied Mathematics, Applicable Analysis, Carpathian Journal of Mathematics, Journal of Fluids, Journal of Computational and Applied Mathematics, Advances in Water Resources, Journal of Fluid Mechanics, Computer and Mathematics with Applications, Journal of Computational Physics, Journal of Numerical Mathematics

Invited work visits

Institut für Angewandte Mathematik, **University of Heidelberg**, Germany, Jun 19, 2019 – Jun 27, 2019 (Host: Prof. Willi Jäger).

Special Research Fund, BOF Visitor Grant, Hasselt University, Belgium, Aug 15– Sep 14, 2019 (Host: Prof. Sorin Pop).

Indian Institute of Technology Khadagpur, India, Jul 27–Aug 2, 2019 (Host: Prof. Hari Mahato).

Hasselt University, Belgium, Feb 2–Apr 15, 2018 (Host: Prof. Sorin Pop).

Indian Institute of Technology Mandi, India, Nov 24–30, 2017 (Host: Prof. Prashant Jose).

University of Erlangen Nuremberg, Germany, Sep 3–14, 2017 (Host: Dr. Nadja Ray).

Indian Institute of Technology Roorkee, India, July 16–23, 2017 (Host: Prof. Brijesh Yadav).

Tata Institute of Fundamental Research, Bangalore, July 25–30, 2016 (Invitation from Prof. Veerappa Gowda).

Melt in the Mantle, a one semester program at **Isaac Newton Institute for Mathematical Sciences, Cambridge**, Feb – Jun 2016.

RICAM at **Linz**, June 2016 (Invitation from Prof. Ulrich Langer).

Center for Subsurface Modeling, ICES, UT Austin, Dec 2015 (Invitation from Prof. Mary F Wheeler).

Department of Applied Mathematics, **University of Zaragoza**, Spain, Nov 2015 (Invitation from Prof. Francisco Gaspar).

Department of Mathematics, **University of Pittsburgh**, USA, Mar 2014 (Invitation from Prof. Ivan Yotov).

Institut für Angewandte Mathematik, **University of Heidelberg**, Germany, Jan 2010 – Feb 2010 (Invitation from Prof. Willi Jäger).

Institute of Applied Mathematics, **University of Bergen**, Norway, Mar 2012, Oct 2013 (Invitation from Prof. Florin Radu).

Centre for Analysis, Scientific computing and Applications, **Eindhoven University of Technology**, The Netherlands, Jun 2013 – Jul 2013, Dec 2014 – Jan 2015, Sep 2015 (Invitation from Prof. Sorin Pop).