# Curriculum Vitae – Jakub Both, PhD

Researcher
Porous Media Group
Department of Mathematics
University of Bergen, Norway
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Date of birth: Dec 29, 1988
Citizenship: German
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## Current academic employment

**Researcher**, Porous Media Group, Department of Mathematics, University of Bergen, Norway, Jan 2020 – (permanent position)

## Previous work experiences

**Doctoral Student**, UiB research fellowship, Porous Media Group, Department of Mathematics, University of Bergen, Norway, Nov 2015 – Jan 2020 (4 year position)

**Research assistant** for Oliver Sander, IGPM, RWTH Aachen University, Germany, May – Sep 2015

**Research assistant** for Ivar Aavatsmark, Uni Research CIPR, Bergen, Norway, Jan – Apr 2015

**Research assistant** for Lutz Pauli, CATS, RWTH Aachen University, Germany, 2013 – 2014

## Education

**Ph.D.** in **Mathematics**, University of Bergen, Norway, Nov 2019

> **Thesis title: Mathematical and Numerical Analysis of Flow in Deformable Porous Media**
> Department of Mathematics, University of Bergen, Norway
> Main advisor: Prof. Dr. Florin A. Radu
> Co-advisors: Assoc. Prof. Dr. Kundan Kumar, Prof. Dr. Jan M. Nordbotten

**M.Sc. (with distinction)** in **Computational Engineering Science**, RWTH Aachen University, Germany, Oct 2015

> **Thesis title: Analysis of Schur Complement Based Preconditioning of Navier-Stokes Equations**
> CATS, RWTH Aachen University, Germany
> Advisors: Dr. Philipp Knechtges, Prof. Marek Behr Ph.D.

**M.Sc. (with distinction)** in **Mathematics**, RWTH Aachen University, Germany, Sep 2014

> **Thesis title: An efficient numerical treatment of a fractured elastic medium with contact constraints**
> IGPM, RWTH Aachen University, Germany
> Advisor: Prof. Dr. Oliver Sander

**B.Sc. (with distinction)** in **Mathematics**, RWTH Aachen University, Germany, 2011

**Exchange study**, Mathematics, NTNU Trondheim, Norway, Aug 2011 – Jun 2012

**Teaching experiences**

University of Bergen, Department of Mathematics

Course assistant for Linear Algebra Spring 2016, Spring 2017
Course assistant for Introduction to Numerical Methods, Fall 2016
Course assistant for Discrete Mathematics, Fall 2017

RWTH Aachen University, Chair for Mathematics C

Course assistant for Higher Mathematics II, Fall 2013
Course assistant for Higher Mathematics I, Fall 2012
Course assistant for Analysis II, Spring 2011
Course assistant for Analysis I, Fall 2010
Course assistant for Fundamental of Mathematics Analysis, Spring 2010
Course assistant for Analysis for Computer Scientists, Fall 2009

**Supervision of Master students**

Erlend Storvik (2018), *thesis topic*: On the optimization of iterative schemes for solving non-linear and/or coupled PDEs, **Co-supervisor**, **Supervisor: Florin A. Radu**

**Honors and Awards**

**NOACM nominee and finalist** for **ECCOMAS award for the best PhD theses of 2019** on Computational Methods in Applied Sciences and Engineering, 2020

**Travel grants** including **SIAM Student Travel Award** (2017, 2019), **Meltzer Research Fund** (2017, 2018, 2019), **BKK travel grant** (2017), **Equinor-Akademia travel grant** (2016, 2017, 2019), **Domain Decomposition Conference Scholarship** (2016)

**Oberwolfach Leibniz Graduate Student** (OWLG) on occasion of the seminar 'Reactive Flows in Deformable, Complex Media', 2018

**Springorium Commemorative coin** for passing Master exam with distinction, both for Mathematics and Computational Engineering Science, RWTH Aachen University, 2015 and 2016

**Schöneborn Preis** for excellent achievements in B.Sc. Degree, Mathematics, RWTH Aachen University, Germany, 2012

Member on the **Dean's List**, for being among the best 5 percent of students in class, RWTH Aachen University, Germany, 2010 – 2015

**Deutschlandstipendium**, scholarship from the Education Fund of RWTH Aachen University, supported by a donation from Robert Bosch GmbH, 2012 – 2014

**Erasmus Scholarship**, sponsored by European Commission (2011 – 2012) for exchange year at NTNU Trondheim, Norway

**Publications**

**No. of publications: In journals: 4, Pre-prints: 5, Book chapters/proceedings: 6**

**Pre-prints**

M. Bause, **J.W. Both**, F.A. Radu, *Iterative Coupling for Fully Dynamic Poroelasticity*, arXiv:1912.05174 [math.NA], accepted for publication in ENUMATH 2019 proceedings.

E. Storvik, **J.W. Both**, J.M. Nordbotten, F.A. Radu, *The fixed-stress splitting scheme for Biot's equations as a modified Richardson iteration: Implications for optimal convergence*, arXiv:1911.11557

[math.NA], accepted for publication in ENUMATH 2019 proceedings.f

**J.W. Both**, *On the rate of convergence of alternating minimization for non-smooth convex programming in Banach spaces*, arXiv:1911.00404 [math:OC]

**J.W. Both**, K. Kumar, J.M. Nordbotten, F.A. Radu, *The gradient flow structures of thermo-poro-visco-elastic processes in porous media*, arXiv:1907.03134 [math.NA]

**J.W. Both**, I.S. Pop, I. Yotov, *Global existence of a weak solution to unsaturated poroelasticity*, arXiv:1909.06679 [math.AP]

**Journal articles**

E. Storvik, **J.W. Both**, K. Kumar, J.M. Nordbotten, F.A. Radu, On the optimization of the fixed-stress splitting for Biot's equations, **International Journal for Numerical Methods in Engineering**, 2019, DOI: 10.1002/nme.6130

**J.W. 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**, 2018, DOI: 10.1016/j.camwa.2018.07.033

**J.W. Both**, M. Borregales, K. Kumar, J.M. Nordbotten, F.A. Radu, Robust fixed stress splitting for Biot's equations in heterogeneous media, **Applied Mathematics Letters**, 68, 101–108, 2017, DOI: 10.1016/j.aml.2016.12.019

L. Pauli, **J.W. Both**, M. Behr, Stabilized Finite Element Method for Flows with Multiple Reference Frames, **International Journal for Numerical Methods in Fluids**, 78 (11), 657–669, 2015, DOI: 10.1002/fld.4032

**Book chapters and conference proceedings**

**J.W. Both**, J.M. Nordbotten, F.A. Radu, *Free energy diminishing discretization of Darcy-Forchheimer flow in poroelastic media*, International Conference on Finite Volumes for Complex Applications. Springer, Cham, 2020.

**J.W. Both**, U. Köcher, Numerical Investigation on the Fixed-Stress Splitting Scheme for Biot's Equations: Optimality of the Tuning Parameter, **Lecture Notes in Computational Science and Engineering 126**, Springer, 2019, DOI: 10.1007/978-3-319-96415-7_74

**J.W. Both**, K. Kumar, J.M. Nordbotten, I.S. Pop, F.A. Radu, Iterative Linearisation Schemes for Doubly Degenerate Parabolic Equations, **Lecture Notes in Computational Science and Engineering 126**, Springer, 2019, DOI: 10.1007/978-3-319-96415-7_3

**J.W. Both**, K. Kumar, J.M. Nordbotten, F.A. Radu, Linear Biot equations from a gradient flow perspective, **Oberwolfach workshop** on Reactive Flows in Deformable, Complex Media, *Oberwolfach reports*, 2018, DOI: 10.4171/OWR/2018/39

**J.W. Both**, K. Kumar, J.M. Nordbotten, F.A. Radu, Iterative Methods for Coupled Flow and Geomechanics in Unsaturated Porous Media, **Poromechanics VI: Proceedings of the Sixth Biot Conference on Poromechanics. American Society of Civil Engineers (ASCE)**, 2017, DOI: 10.1061/9780784480779.050

**J.W. Both**, S.E. Gasda, I. Aavatsmark, R. Kaufmann, Gravity-driven Convective Mixing of CO2 in Oil, **Proceedings of The Third Sustainable Earth Sciences Conference and Exhibition**, 2015, DOI: 10.3997/2214-4609.201414266

**Talks at International Conferences and Seminars**

**J.W. Both**, J.M. Nordbotten, F.A. Radu, *Free energy diminishing discretization of Darcy-Forchheimer flow in poroelastic media*, International Conference on Finite Volumes for Complex Applications, Bergen, June 15–19, 2020

**On iterative solvers for nonlinear, coupled problems in porous media**, *keynote on behalf of Florin A. Radu*, Workshop on Recent Developments in Modelling, Analysis, and Simulation of Processes in Porous Media, Friedrich-Alexander University of Erlangen-Nürnberg, Germany, Mar 5–6, 2020

**Robust iterative solvers for thermo-poro-visco-elasticity via gradient flows**, Seminar at INRIA Paris (on invitation by Alexandre Ern), Paris, France, Feb 25, 2020

**The gradient flow structures of poro-visco-elasticity**, Kalvåg workshop on Analysis and Computation of Coupled Problems, Kalvåg, Norway, Nov 27–29, 2019

**Gradient flow perspective on poromechanics**, SIAM Geoscience 2019, Houston, TX, USA, Mar 11–14, 2019

**Gradient flow framework for poro-elasticity**, Computational Mathematics Seminar, University of Pittsburgh, PA, USA, Feb 26, 2019

**Simulation flow in deformable porous media with dune-biot**, DUNE User Meeting 2018, Stuttgart, Germany, Nov 5–6, 2018

**Robust splitting schemes for nonlinear Biot equations**, IRTG-IMPM Doctoral Workshop 2018, SFB1313, Hechingen, Germany, Sep 24–26, 2018

**Iterative splitting schemes for coupled flow and geomechanics in porous media**, Nasjonalt Matematikermøte (National mathematicians meeting) i Bergen (PhD day), Bergen, Norway, Sep 12–14, 2018

**Iterative Splittings for Unsaturated Poromechanics and Gradient Flows**, Oberwolfach Seminar *Reactive Flows in Deformable, Complex Media*, Oberwolfach, Germany, Aug 26–31, 2018

**Poromechanics based on Minimization – Models and Solvers**, CMWR 2018, Saint Malo, France, Jun 3–7, 2018

**Anderson accelerated splitting schemes for unsaturated fluid flow in deformable porous media**, CMAT Seminar, University of Hasselt, Belgium, Mar 7, 2018

**Iterative methods for coupled flow and geomechanics in unsaturated porous media**, Poroelasticity Workshop 2017, Hamburg, Germany, Dec 4–6, 2017

**Accelerated iterative schemes for poromechanics**, ENUMATH 2017, Voss, Norway, Sep 25–29, 2017

**Robust iterative schemes for unsaturated poromechanics**, ACOMEN 2017, Ghent, Belgium, Sep 18–22, 2017

**Linearization for coupled water flow and mechanical deformation in unsaturated soil**, SIAM Geoscience 2017, Erlangen, Germany, Sep 11–14, 2017

**Numerical solution of nonlinear Biot's equations**, X-DMS 2017, Umeå, Sweden, Jun 19–21, 2017

**Robust linearization of coupled flow and geomechanics in unsaturated porous media**, Workshop on 'Advances in modeling flow and deformation in unsaturated porous media', Utrecht,

Netherlands, Mar 20–21, 2017

**An efficient numerical treatment of a fractured, elastic medium with contact constraints**, International Conference on Domain Decomposition Methods DD24, Longyearbyen, Norway, Feb 6–10, 2017

**Linearization of coupled flow and geomechanics in unsaturated porous media**, NUPUS Student Trip, Politecnico di Milano, Italy, Jan 20, 2017

**Numerische Lösung gekoppelter Grundwasserströmung und Bodenverformung**, Numerik Seminar, TU Dresden, Germany, Jan 10, 2017

**Linearization and splitting schemes for coupled flow and geomechanics in partially saturated porous media**, CMAT Seminar, University of Hasselt, Belgium, Dec 20, 2016

**Convergence of iterative coupling for linearized Biot's equations**, Seminar, University of Erlangen, Germany, Oct 11, 2016

**Iterative methods for coupled flow and geomechanics in unsaturated porous media**, 1st SRP NUPUS meeting, Mühlhausen im Täle, Germany, Oct 5–7, 2016

**Iterative methods for coupled flow and geomechanics problems in partially saturated porous media**, Multiscale Inverse Problems, Loka Brunn, Sweden, Aug 22–26, 2016

**Posters at International Conferences and Seminars**

**Gradient flow perspective on Poro-elasticity & Energy minimizing splitting schemes**, InterPore 2019, Valencia, Spain, May 2019

**Iterative Coupling of Mechanical Deformation and Flow in Unsaturated Porous Media**, Modeling and Benchmarking of Fractured Porous Media Workshop 2017, Bergen, Norway, Jun 8–9, 2017

**Iterative methods for coupled flow and geomechanics in unsaturated porous media**, Norwegian Chapter of InterPore Kick-off Meeting, Bergen, Norway, Sep 23, 2016

**Professional Activities**

**Organizing committee**, Workshop on **Analysis and computation of coupled problems**, Nov 27–29, 2019, Kalvåg, Norway (together with Elyes Ahmed, Mats Brun, Jan M. Nordbotten (chair), Florin A. Radu)

**Local organizing committee**, **ENUMATH 2017 conference**, Sep 25–29, 2017, Voss, Norway (together with Inga Berre, Petter E. Bjørstad, Helge K. Dahle, Kundan Kumar, Hans Munthe-Kaas, Florin A. Radu (chair))

**Organizing committee**, **NUPUS Student Trip 2017**, Jan 16–20, 2017, University of Stuttgart, Germany (Group of Rainer Helmig) and Politecnico di Milano, Italy (Group of Luca Formaggia) (together with Alessio Fumagalli)

**Reviewer**, Computers and Mathematics with Applications, Conference Proceedings for the 6th Biot Conference, Conference Proceedings for FVCA IX

**Invited work visits**

Department of Mathematics, **University of Pittsburgh**, USA, Feburary 10 – Mar 10, 2019 (Invitation by Ivan Yotov)

CMAT, **University of Hasselt**, Belgium, Mar 5–23, 2018 (Invitation by Sorin Pop)

Institut für Numerische Mathematik, **TU Dresden**, Germany, Jan 9–13, 2017 (Invitation by Oliver Sander)

CMAT, **University of Hasselt**, Belgium, Dec 7–21, 2016 (Invitation by Sorin Pop)

Lehrstuhl für Angewandte Mathematik 1, **University of Erlangen**, Germany, Oct 10–14, 2016 (Group of Peter Knabner)

Institut für Numerische Mathematik, **TU Dresden**, Germany, Oct 26–30, 2015 (Invitation by Oliver Sander)