Curriculum Vitæ et Studiorum

Alessio Fumagalli, Ph.D.

Department of Mathematics, Politecnico di Milano, Italy

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Personal data

Citizenship Italian

Birth 4 Dec. 1984. Lecco, LC, Italy

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Government classification

Scientific-disciplinary sector (SSD): MATH-05/A - Numerical analysis
Scientific-disciplinary group (GSD): 01/MATH-05 - Numerical analysis

Professional experience

2022, Dec. – Associate Professor at the Department of Mathematics, Politecnico di Milano, Italy.

2019, Dec. – 2022, Nov. Assistant Professor Tenure Track (RTD-B) at the Department of Mathematics, Politecnico di Milano, Italy.

2018, Oct. – 2019, Aug. Visiting Professor at the Department of Mathematical Sciences (DISMA), Politecnico di Torino, Italy.

2015, Oct. – 2018, Sep. Postdoctoral fellowship at the Department of Mathematics, University of Bergen, Norway. Responsible Eirik Keilegavlen and Inga Berre. Project *An integrated geological and mathematical framework for the characterization, modelling and simulation of fractured geothermal reservoir*. In collaboration with the Department of Earth Science, University of Bergen, Bergen, Norway.

2014, Mar. – 2015, Sep. Postdoctoral fellowship at the Department of Mathematics, Politecnico di Milano, Italy. Responsible Luca Formaggia. Project *Numerical methods for upscaling in fractured and heterogeneous porous media*. In collaboration with MOXOFF S.p.a. and ENI S.p.a. Exploration & Production Division.

2013, Mar. – 2014, Feb. Postdoctoral fellowship at the Department of Technologie, Informatique et Mathématiques Appliquées, Institut Française du Pétrole - Energies nouvelles (IFP - Energies nouvelles), Rueil-Malmaison, Paris, France. Responsible Isabelle Faille. Project *Hybrid schemes for conductive fault modelling*. In collaboration with the research group POMDAPI at Institut national de recherche en informatique et en automatique (Inria) Paris-Rocquencourt: Jérôme Jaffré and Jean E. Roberts.

2012, May – 2013, Feb. Postdoctoral fellowship at the Department of Mathematics, Politecnico di Milano, Italy. Responsible Luca Formaggia. Project *Three-dimensional numerical modelling for two-phases flows in fractured porous media and in parallel computing framework*. In collaboration with ENI S.p.a. Exploration & Production Division.

2010, Sep. and 2011, Feb. Scientific collaboration with Michel Kern, Inria-Roquencourt, Paris France, in writing and testing a three-dimensional two-phase flow solver in a parallel computing framework.

Education

2009, Jan. – 2012, May Doctor of Philosophy in Mathematical Models and Methods in Engineering at Politecnico di Milano, Italy. Thesis *Numerical Modelling of Flows in Fractured Porous Media by the XFEM Method*. Advisor Luca Formaggia. External examiners Paolo Ruffo and Jérôme Jaffré.
Members of the dissertation committee: Maurizio Falcone, Miguel Fernandez, Jérôme Jaffré, Paolo Ruffo, Enrico Zio. Defence 8 May 2012.
In collaboration with ENI S.p.a. Exploration & Production Division.

2006, Sep. – 2008, Dec. Master degree in Mathematical Engineering at Politecnico di Milano, Italy. Thesis *A free discontinuity problem for an elastic-plastic cantilever*. Advisor Franco Tomarelli.

2003, Sep. – 2006, Sep. Bachelor degree in Mathematical Engineering at Politecnico di Milano, Italy. Thesis *Adaptive algorithms for the Black & Scholes equation*. Advisor Alessandro Veneziani.

Italian national scientific qualification

Valid from the 11 Dec. 2023 to 11 Dec. 2034 for the academic discipline 01/A5 - Numerical Analysis (MAT/08) qualification as Full Professor.

Research outline

Starting from my Ph.D., the central thread of my research is to introduce, extend, and analyse advanced mathematical models and non-standard numerical schemes, to facilitate and increase the knowledge of flow in fractured porous media. Keeping in mind real applications, I focused my research mainly on 2 aspects. 1) To derive appropriate reduced order models (hybrid-dimensional approach) to accurately describe the scalar transport, single-phase and multi-phase flow in a complex system of fractures. Particular attention is devoted to the mutual interaction between fractures and between a fracture and the surrounding rock matrix. 2) To facilitate the numerical solution of such models by studying non-standard numerical schemes (*e.g.* XFEM, VEM), where the structural geometrical constraints imposed by the fractures are consistently relaxed. This allows the solution of more complex problems in an affordable amount of time and lightens the gridding process.

Scientific activities

Articles published

[A56] HuaiZheng Wang, Bo Wen, Alessio Fumagalli, Marco Berardi, Jie Cao, and Jiwen Zhang. "Evolution of mechanical properties and damage constitutive modeling of composite waste glass concrete under high-temperature sustained loading conditions". In: *Construction and Building Materials* 520 (2026), p. 146025. ISSN: 0950-0618. DOI: 10.1016/j.conbuildmat.2026.146025.
URL: https://www.sciencedirect.com/science/article/pii/S0950061826009311

[A55] Enrico Ballini, Alberto Cominelli, Laura Dovera, Alice Forello, Luca Formaggia, Alessio Fumagalli, Stefano Nardean, Anna Scotti, and Paolo Zunino. "Enhancing computational efficiency of numerical simulation for subsurface fluid-induced deformation using Deep Learning Reduced Order Models". In: *Computational Geosciences* (2026). Accepted.

[A54] Yongkang Kang, Bo Wen, Shuaishuai Ji, Alessio Fumagalli, Zhengyao Yu, and Wen Xia. "Hysteretic behavior of a tandem self-centering double-stage yielding buckling-restrained brace". In: *Journal of Constructional Steel Research* 240 (2026), p. 110254. ISSN: 0143-974X. DOI: 10.1016/j.jcsr.2026.110254.
URL: https://www.sciencedirect.com/science/article/pii/S0143974X26000234

[A53] Wietse M. Boon, Nicola R. Franco, Alessio Fumagalli, and Paolo Zunino. "Deep learning based reduced order modeling of Darcy flow systems with local mass conservation". In: *International Journal for Numerical Methods in Engineering* (2025). Accepted. DOI: 10.1002/nme.70188.
URL: https://onlinelibrary.wiley.com/doi/10.1002/nme.70188

[A52] Chiara Giovannini, Alessio Fumagalli, and Francesco Patacchini. "Predicting nonlinear-flow regions in highly heterogeneous porous media using adaptive constitutive laws and neural networks". In: *Journal of Computational Physics* 537 (2025). DOI: 10.1016/j.jcp.2025.114093.
URL: https://www.sciencedirect.com/science/article/pii/S0021999125003766

[A51] Arash Andrea Roknian, Anna Scotti, and Alessio Fumagalli. "Free convection in fractured porous media: a numerical study". In: *Advances in Water Resources* 202 (2024). DOI: https://doi.org/10.1016/j.advwatres.2025.104988.
URL: https://www.sciencedirect.com/science/article/pii/S0309170825001022

[A50] Lorenzo Panzeri, Alessio Fumagalli, Laura Longoni, Monica Papini, and Diego Arosio. "Sensitivity analysis with a 3D mixed-dimensional code for DC geoelectrical investigations of landfills: synthetic tests". In: *Geophysical Prospecting* (2025). DOI: 10.1111/1365-2478.70006.
URL: https://onlinelibrary.wiley.com/doi/abs/10.1111/1365-2478.70006

[A49] Wietse M. Boon, Nicola R. Franco, and Alessio Fumagalli. "Neural network solvers for parametrized elasticity problems that conserve linear and angular momentum". In: *Computer Methods in Applied Mechanics and Engineering* 437 (2025). DOI: 10.1016/j.cma.2025.117759.
URL: https://www.sciencedirect.com/science/article/pii/S0045782525000313

[A48] Zhilin Cao, Zhanping Song, Weichen Sun, Qiang Xie, Alessio Fumagalli, Xiaoxu Tian, and XiaoLe Shen. "A numerical approach for CFD-DEM coupling method with pore network model considering the effect of anisotropic permeability in soil-rock mixtures". In: *Computers and Geotechnics* 178 (2025), p. 106898. ISSN: 0266-352X. DOI: 10.1016/j.compgeo.2024.106898.
URL: https://www.sciencedirect.com/science/article/pii/S0266352X24008371

[A47] Alessio Fumagalli and Francesco Saverio Patacchini. "Numerical validation of an adaptive model for the determination of nonlinear-flow regions in highly heterogeneous porous media". In: *Mathematics and Computers in Simulation* 230 (2025), pp. 306–322. DOI: 10.1016/j.matcom.2024.10.024.
URL: https://www.sciencedirect.com/science/article/pii/S0378475424004233

[A46] Enrico Ballini, Luca Formaggia, Alessio Fumagalli, Eirik Keilegavlen, and Anna Scotti. "A hybrid upwind scheme for two-phase flow in fractured porous media". In: *Computer Methods in Applied Mechanics and Engineering* 432 (2024). ISSN: 0045-7825. DOI: 10.1016/j.cma.2024.117437.
URL: https://www.sciencedirect.com/science/article/pii/S0045782524006923

[A45] Federico Gatti, Andrea Bressan, Alessio Fumagalli, Domenico Gallipoli, Leonardo Maria Lalicata, Simone Pittaluga, and Lorenzo Tamellini. "Two Nitsche-based mixed finite element discretizations for the seepage problem in Richards' equation". In: *Computer Methods in Applied Mechanics and Engineering* 432 (2024). DOI: 10.1016/j.cma.2024.117368.
URL: https://www.sciencedirect.com/science/article/pii/S0045782524006236

[A44] Enrico Ballini, Luca Formaggia, Alessio Fumagalli, Anna Scotti, and Paolo Zunino. "Application of Deep Learning Reduced-Order Modeling for Single-Phase Flow in Faulted Porous Media". In: *Computational Geosciences* (2024). ISSN: 1573-1499. DOI: 10.1007/s10596-024-10320-y.
URL: https://link.springer.com/article/10.1007/s10596-024-10320-y

[A43] Qiang Xie, Zhilin Cao, Renjun Tian, Weichen Sun, Alessio Fumagalli, Haiyou Peng, Xiang Fu, and Haoyang Luo. "Complex sliding characteristics of landslides and evaluation of the reinforcement with arched anti-slide piles based on 3D discrete element method: a case study". In: *Natural Hazards* (Apr. 2024). ISSN: 1573-0840. DOI: 10.1007/s11069-024-06564-7.
URL: https://doi.org/10.1007/s11069-024-06564-7

[A42] Alessio Fumagalli, Lorenzo Panzeri, Luca Formaggia, Anna Scotti, and Diego Arosio. "A mixed-dimensional model for direct current simulations in presence of a thin high-resistivity liner". In: *International Journal for Numerical Methods in Engineering* (2023). DOI: 10.1002/nme.7407.
URL: https://onlinelibrary.wiley.com/doi/10.1002/nme.7407

[A41] Franco Dassi, Alessio Fumagalli, Ilario Mazzieri, and Giuseppe Vacca. "Mixed Virtual Element approximation of linear acoustic wave equation". In: *IMA Journal of Numerical Analysis* (Oct. 2023), pp. 1–28. ISSN: 0272-4979. DOI: 10.1093/imanum/drad078.
URL: https://academic.oup.com/imajna/advance-article/doi/10.1093/imanum/drad078/7310895

[A40] Michele Botti, Alessio Fumagalli, and Anna Scotti. "Uncertainty quantification for mineral precipitation and dissolution in fractured porous media". In: *GEM - International Journal on Geomathematics* 14.1 (July 2023), p. 21. ISSN: 1869-2680. DOI: 10.1007/s13137-023-00231-y.
URL: https://link.springer.com/article/10.1007/s13137-023-00231-y

[A39] Wietse M. Boon, Alessio Fumagalli, and Anna Scotti. "Mixed and multipoint finite element methods for rotation-based poroelasticity". In: *SIAM Journal on Numerical Analysis* 61.5 (2023), pp. 2485–2508. DOI: 10.1137/22M154329X.
URL: https://epubs.siam.org/doi/full/10.1137/22M154329X

[A38] Wietse M. Boon and Alessio Fumagalli. "A Reduced Basis Method for Darcy flow systems that ensures local mass conservation by using exact discrete complexes". In: *Journal of Scientific Computing* 94.3 (2023). DOI: https://doi.org/10.1007/s10915-023-02119-3.
URL: https://link.springer.com/article/10.1007/s10915-023-02119-3

[A37] Qiang Xie, Zhilin Cao, Weichen Sun, Alessio Fumagalli, Xiang Fu, Zhihui Wu, and Kai Wu. "Numerical simulation of the fluid-solid coupling mechanism of water and mud inrush in a water-rich fault tunnel". In: *Tunnelling and Underground Space Technology* 131 (2023), p. 104796. ISSN: 0886-7798. DOI: https://doi.org/10.1016/j.tust.2022.104796.
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[A36] Alessio Fumagalli and Francesco Saverio Patacchini. "Well-posedness and variational numerical scheme for an adaptive model in highly heterogeneous porous media". In: *Journal of Computational Physics* 475 (2023). ISSN: 0021-9991. DOI: 10.1016/j.jcp.2022.111844.
URL: https://www.sciencedirect.com/science/article/pii/S002199912200907X

[A35] Wietse M. Boon and Alessio Fumagalli. "A multipoint vorticity mixed finite element method for incompressible Stokes flow". In: *Applied Mathematics Letters* 137 (2023). DOI: 10.1016/j.aml.2022.108498.
URL: https://www.sciencedirect.com/science/article/pii/S0893965922003615

[A34] Zhilin Cao, Weichen Sun, Qiang Xie, Zhihui Wu, Xiang Fu, Alessio Fumagalli, Dalang Tian, and Li Liang. "Fluid-solid coupled model for the internal erosion of gap-graded soil-rock mixtures with different fines contents: its verification and application". In: *Hydrological Processes* 36.9 (2022). DOI: 10.1002/hyp.14677.
URL: https://onlinelibrary.wiley.com/doi/10.1002/hyp.14677

[A33] Franco Dassi, Alessio Fumagalli, Anna Scotti, and Giuseppe Vacca. "Bend 3d Mixed Virtual Element Method for Elliptic Problems". In: *Computers and Mathematics with Applications* 119 (2022), pp. 1–12. ISSN: 0898-1221. DOI: 10.1016/j.camwa.2022.05.023.
URL: https://www.sciencedirect.com/science/article/pii/S0898122122002140

[A32] Alessio Fumagalli and Francesco Saverio Patacchini. "Model adaptation for non-linear elliptic equations in mixed form: existence of solutions and numerical strategies". In: *ESAIM: Mathematical Modelling and Numerical Analysis* 56.2 (2022), pp. 565–592. DOI: 10.1051/m2an/2022016.
URL: https://www.esaim-m2an.org/articles/m2an/abs/2022/02/m2an210134/m2an210134.html

[A31] Franco Dassi, Alessio Fumagalli, Ilario Mazzieri, Anna Scotti, and Giuseppe Vacca. "A Virtual Element Method for the wave equation on curved edges in two dimensions". In: *Journal of Scientific Computing* 90.1 (2021). ISSN: 1573-7691. DOI: 10.1007/s10915-021-01683-w.
URL: https://link.springer.com/article/10.1007%2Fs10915-021-01683-w

[A30] Franco Dassi, Alessio Fumagalli, Davide Losapio, Stefano Scialò, Anna Scotti, and Giuseppe Vacca. "The Mixed Virtual Element Method on curved edges in two dimensions". In: *Computer Methods in Applied Mechanics and Engineering* 386 (2021). ISSN: 0045-7825. DOI: 10.1016/j.cma.2021.114098.
URL: https://www.sciencedirect.com/science/article/pii/S0045782521004291

[A29] Luca Formaggia, Alessio Fumagalli, and Anna Scotti. "A multi-layer reactive transport model for fractured porous media". In: *Mathematics in Engineering* 4.1 (2021), pp. 1–32. DOI: 10.3934/mine.2022008.
URL: https://www.aimspress.com/article/10.3934/mine.2022008

[A28] Alessio Fumagalli and Anna Scotti. "A mathematical model for thermal single-phase flow and reactive transport in fractured porous media". In: *Journal of Computational Physics* 434 (2021). DOI: 10.1016/j.jcp.2021.110205.
URL: https://www.sciencedirect.com/science/article/pii/S0021999121001005

[A27] Elyes Ahmed, Alessio Fumagalli, Ana Budiša, Eirik Keilegavlen, Jan M. Nordbotten, and Florin A. Radu. "Robust linear domain decomposition schemes for reduced non-linear fracture flow models". In: *SIAM Journal on Numerical Analysis* 59.1 (2021), pp. 583–612. DOI: 10.1137/19M1268392.
URL: https://epubs.siam.org/doi/abs/10.1137/19M1268392

[A26] Inga Berre, Wietse M. Boon, Bernd Flemisch, Alessio Fumagalli, Dennis Gläser, Eirik Keilegavlen, Anna Scotti, Ivar Stefansson, Alexandru Tatomir, Konstantin Brenner, Samuel Burbulla, Philippe Devloo, Omar Duran, Marco Favino, Julian Hennicker, I-Hsien Lee, Konstantin Lipnikov, Roland Masson, Klaus Mosthaf, Maria Giuseppina Chiara Nestola, Chuen-Fa Ni, Kirill Nikitin, Philipp Schädle, Daniil Svyatskiy, Ruslan Yanbarisov, and Patrick Zulian. "Verification benchmarks for single-phase flow in three-dimensional fractured porous media". In: *Advances in Water Resources* 147 (2020). ISSN: 0309-1708. DOI: 10.1016/j.advwatres.2020.103759.
URL: http://www.sciencedirect.com/science/article/pii/S0309170820301603

[A25] Eirik Keilegavlen, Runar Berge, Alessio Fumagalli, Michele Starnoni, Ivar Stefansson, Jhabriel Varela, and Inga Berre. "PorePy: An Open-Source Software for Simulation of Multiphysics Processes in Fractured Porous Media". In: *Computational Geosciences* (2020). ISSN: 1573–1499. DOI: 10.1007/s10596-020-10002-5.
URL: https://link.springer.com/article/10.1007%2Fs10596-020-10002-5

[A24] Andrea Borio, Alessio Fumagalli, and Stefano Scialò. "Comparison of the response to geometrical complexity of methods for unstationary simulations in discrete fracture networks with conforming, polygonal, and non-matching grids". In: *Computational Geosciences* (2020). DOI: 10.1007/s10596-020-09996-9.
URL: https://link.springer.com/article/10.1007/s10596-020-09996-9

[A23] Luca Formaggia, Anna Scotti, and Alessio Fumagalli. "Numerical Methods for Flow in Fractured Porous Media". In: *Encyclopedia of Solid Earth Geophysics*. Ed. by Harsh K. Gupta. Springer International Publishing, 2021, pp. 1125–1130. ISBN: 978-3-030-58631-7. DOI: 10.1007/978-3-030-58631-7_289.
URL: https://doi.org/10.1007/978-3-030-58631-7_289

[A22] Alessio Fumagalli, Anna Scotti, and Luca Formaggia. "Performances of the Mixed Virtual Element Method on Complex Grids for Underground Flow". In: *Polyhedral Methods in Geosciences*. Ed. by Daniele Antonio Di Pietro, Luca Formaggia, and Roland Masson. Cham: Springer International Publishing, 2021, pp. 299–329. ISBN: 978-3-030-69363-3. DOI: 10.1007/978-3-030-69363-3_8.
URL: https://doi.org/10.1007/978-3-030-69363-3_8

[A21] Alessio Fumagalli and Anna Scotti. "A multi-layer reduced model for flow in porous media with a fault and surrounding damage zones". In: *Computational Geosciences* 24.3 (2020), pp. 1347–1360. ISSN: 1573-1499. DOI: 10.1007/s10596-020-09954-5.
URL: https://link.springer.com/article/10.1007%2Fs10596-020-09954-5

[A20] Elyes Ahmed, Alessio Fumagalli, and Ana Budiša. "A Multiscale Flux Basis for Mortar Mixed Discretizations of Reduced Darcy-Forchheimer Fracture Models". In: *Computer Methods in Applied Mechanics and Engineering* 354 (2019), pp. 16–36. DOI: 10.1016/j.cma.2019.05.034.
URL: https://www.sciencedirect.com/science/article/pii/S0045782519303044

[A19] Alessio Fumagalli and Eirik Keilegavlen. "Dual Virtual Element Methods for Discrete Fracture Matrix Models". In: *Oil & Gas Science and Technology - Revue d'IFP Energies nouvelles* 74.41 (2019), pp. 1–17. DOI: 10.2516/ogst/2019008.
URL: https://ogst.ifpenergiesnouvelles.fr/articles/ogst/full_html/2019/01/ogst170210/ogst170210.html

[A18] Alessio Fumagalli, Eirik Keilegavlen, and Stefano Scialò. "Input and benchmarking data for flow simulations in discrete fracture networks". In: *Data in Brief* 21 (2018), pp. 1135–1139. ISSN: 2352-3409. DOI: 10.1016/j.dib.2018.10.088.
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[A17] Alessio Fumagalli, Eirik Keilegavlen, and Stefano Scialò. "Conforming, non-conforming and non-matching discretization couplings in discrete fracture network simulations". In: *Journal of Computational Physics* 376 (2019), pp. 694–712. DOI: 10.1016/j.jcp.2018.09.048.
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[A16] Jan Martin Nordbotten, Wietse Boon, Alessio Fumagalli, and Eirik Keilegavlen. "Unified approach to discretization of flow in fractured porous media". In: *Computational Geosciences* 23.2 (2019), pp. 225–237. ISSN: 1573–1499. DOI: 10.1007/s10596-018-9778-9.
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[A15] Alessio Fumagalli. "Dual virtual element method in presence of an inclusion". In: *Applied Mathematics Letters* 86 (Dec. 2018), pp. 22–29. DOI: 10.1016/j.aml.2018.06.004.
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[A14] Alessio Fumagalli and Isabelle Faille. "A double-layer reduced model for fault flow on slipping domains with hybrid finite volume scheme". In: *SIAM Journal on Scientific Computing* 77 (June 2018), pp. 1–26. DOI: 10.1007/s10915-018-0740-8.
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[A13] Bernd Flemisch, Inga Berre, Wietse Boon, Alessio Fumagalli, Nicolas Schwenck, Anna Scotti, Ivar Stefansson, and Alexandru Tatomir. "Benchmarks for single-phase flow in fractured porous media". In: *Advances in Water Resources* 111 (Jan. 2018), pp. 239–258. DOI: 10.1016/j.advwatres.2017.10.036.
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[A12] Alessio Fumagalli and Eirik Keilegavlen. "Dual Virtual Element Method for Discrete Fractures Networks". In: *SIAM Journal on Scientific Computing* 40.1 (2018), B228–B258. DOI: 10.1137/16M1098231.
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[A10] Marco Del Pra, Alessio Fumagalli, and Anna Scotti. "Well posedness of fully coupled fracture/bulk Darcy flow with XFEM". in: *SIAM Journal on Numerical Analysis* 55.2 (2017), pp. 785–811. DOI: 10.1137/15M1022574.
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[A9] Bernd Flemisch, Alessio Fumagalli, and Anna Scotti. "A Review of the XFEM-Based Approximation of Flow in Fractured Porous Media". In: *Advances in Discretization Methods: Discontinuities, Virtual Elements, Fictitious Domain Methods*. Ed. by Giulio Ventura and Elena Benvenuti. Vol. 12. SEMA SIMAI Springer Series. Cham: Springer International Publishing, 2016. Chap. Advances in Discretization Methods, pp. 47–76. ISBN: 978-3-319-41246-7. DOI: 10.1007/978-3-319-41246-7_3.
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[A8] Alessio Fumagalli, Luca Pasquale, Stefano Zonca, and Stefano Micheletti. "An upscaling procedure for fractured reservoirs with embedded grids". In: *Water Resources Research* 52.8 (2016), pp. 6506–6525. ISSN: 1944-7973. DOI: 10.1002/2015WR017729.
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[A7] Isabelle Faille, Alessio Fumagalli, Jérôme Jaffré, and Jean Elisabeth Roberts. "Model reduction and discretization using hybrid finite volumes of flow in porous media containing faults". In: *Computational Geosciences* 20.2 (2016), pp. 317–339. ISSN: 1573-1499. DOI: 10.1007/s10596-016-9558-3.
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[A6] Alberto Ferroni, Luca Formaggia, and Alessio Fumagalli. "Numerical analysis of Darcy problem on surfaces". In: *ESAIM: Mathematical Modelling and Numerical Analysis* (2015). DOI: 10.1051/m2an/2015095.
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[A5] Mauro Castelli and Alessio Fumagalli. "An evolutionary system for exploitation of fractured geothermal reservoirs". In: *Computational Geosciences* 20.2 (2016), pp. 385–396. ISSN: 1573-1499. DOI: 10.1007/s10596-015-9552-1.
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URL: https://ogst.ifpenergiesnouvelles.fr/articles/ogst/abs/2014/04/ogst130007/ogst130007.html

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URL: https://www.sciencedirect.com/science/article/pii/S0309170813000523

[A1] Alessio Fumagalli and Anna Scotti. "Numerical modelling of multiphase subsurface flow in the presence of fractures". In: *Communications in Applied and Industrial Mathematics* 3.1 (2011). ISSN: 2038-0909. DOI: 10.1685/journal.caim.380.
URL: http://caim.simai.eu/index.php/caim/article/view/380

Conference proceedings

[P9] L. Panzeri, A. Fumagalli, L. Zanzi, L. Longoni, M. Papini, and D. Arosio. "Validation of a Mixed-Dimensional Code for the Analysis of Highly Resistive Liners in Landfills". In: *European Association of Geoscientists & Engineers*. 1. 2023, pp. 1–5. DOI: 10.3997/2214-4609.202320123.
URL: https://www.earthdoc.org/content/papers/10.3997/2214-4609.202320123

[P8] Lorenzo Panzeri, Alessio Fumagalli, Alessandro Aguzzoli, Luigi Zanzi, Laura Longoni, Monica Papini, and Diego Arosio. "Lab and modelling DC Resistivity Tests to Analyse the Response of a High Resistivity Liner". In: *5th Asia Pacific Meeting on Near Surface Geoscience & Engineering*. Vol. 2023. 1. European Association of Geoscientists & Engineers, 2023, pp. 1–5. DOI: 10.3997/2214-4609.202378014.
URL: https://www.earthdoc.org/content/papers/10.3997/2214-4609.202378014

[P7] Alessandro Aguzzoli, Alessio Fumagalli, Anna Scotti, Luigi Zanzi, and Diego Arosio. "Inversion of Synthetic and Measured 3D Geoelectrical Data to Study the Geomembrane below a Landfill". In: *4th Asia Pacific Meeting on Near Surface Geoscience & Engineering*. Vol. 2021. 1. European Association of Geoscientists & Engineers, 2021, pp. 1–5. DOI: 10.3997/2214-4609.202177072.
URL: https://www.earthdoc.org/content/papers/10.3997/2214-4609.202177072

[P6] Alessio Fumagalli and Anna Scotti. "Reactive Flow in Fractured Porous Media". In: *Finite Volumes for Complex Applications IX - Methods, Theoretical Aspects, Examples*. Ed. by Robert Klöfkorn, Eirik Keilegavlen, Florin A. Radu, and Jürgen Fuhrmann. Cham: Springer International Publishing, 2020, pp. 55–73. ISBN: 978-3-030-43651-3.

[P5] Eirik Keilegavlen, Alessio Fumagalli, Runar Berge, and Ivar Stefansson. "Implementation of Mixed-Dimensional Models for Flow in Fractured Porous Media". In: *Numerical Mathematics and Advanced Applications ENUMATH 2017*. Ed. by Florin Adrian Radu, Kundan Kumar, Inga Berre, Jan Martin Nordbotten, and Iuliu Sorin Pop. Vol. 126. Springer International Publishing, 2019, pp. 573–580. ISBN: 978-3-319-96415-7. DOI: 10.1007/978-3-319-96415-7_52.
URL: https://link.springer.com/chapter/10.1007/978-3-319-96415-7_52

[P4] Alessio Fumagalli and Stefano Zonca. "An efficient upscaling procedure for highly fractured reservoirs". In: *Proceedings of the 6th International Conference on Approximation Methods and Numerical Modelling in Environment and Natural Resources*. 2015.

[P3] Luca Formaggia, Anna Scotti, and Alessio Fumagalli. "The Challenge of Complexity in Sedimentary and Reservoir Simulations". In: *Proceedings of the 23rd Conference on Computational Mechanics ACME-UK 2015*. Ed. by Antonio J. Gil and Rubén Sevilla. Apr. 2015, pp. 33–36. ISBN: 978-0-9567462-4-5.
URL: http://eng-intranet-web.swan.ac.uk/acme2015/ACMEUK2015.pdf

[P2] Alessio Fumagalli and Anna Scotti. "A Reduced Model for Flow and Transport in Fractured Porous Media with Non-matching Grids". In: *Numerical Mathematics and Advanced Applications 2011*. Ed. by Andrea Cangiani, Ruslan L. Davidchack, Emmanuil Georgoulis, Alexander N. Gorban, Jeremy Levesley, and Michael V. Tretyakov. Springer Berlin Heidelberg, 2013, pp. 499–507. ISBN: 978-3-642-33133-6. DOI: 10.1007/978-3-642-33134-3_53.
URL: https://link.springer.com/chapter/10.1007/978-3-642-33134-3_53

[P1] Alessio Fumagalli and Anna Scotti. "An unfitted method for two-phase flow in fractured porous media". In: *CMWR 2012 Proceedings*. 2012.
URL: http://cmwr2012.cee.illinois.edu/Papers/Special%20Sessions/CO2%20Sequestration/Scotti.Anna.pdf

Articles submitted for review

[S6] Luigi Bruno, Alessio Mainini, Luca Demurtas, Diego Arosio, Alessio Fumagalli, Alessandro Ghinoi, Giacomo Carloni, and Luca Martelli. "Integrated geophysical and stratigraphic surveys for fault mapping at the Apennine-Po Plain margin, northern Italy". Submitted to: Engineering Geology. 2026.

[S5] Luca Muscarnera, Luigi Loreti, Giovanni Todeschini, Alessio Fumagalli, and Francesco Regazzoni. "Emergence of Structure in Ensembles of Random Neural Networks". Submitted to Journal of Machine Learning Research. 2025. DOI: https://doi.org/10.48550/arXiv.2505.10331.

[S4] Wietse Marijn Boon, Alessio Fumagalli, Jan Martin Nordbotten, and Ivan Yotov. "Multipoint stress mixed finite element methods for the linear Cosserat equations". Submitted to Computers and Mathematics with Applications. 2025. DOI: 10.48550/arXiv.2511.06861.

[S3] Bo Wen, Ditao Niu, Anbang Li, Bingbing Guo, Jiyuan Yu, Yao Lv, Alessio Fumagalli, and Marco Berardi. "Sustainable Design Optimization of Concrete Frame Beams: An Analysis of Service Life, Carbon Emissions, and Costs". Submitted to Structures. 2025.

[S2] Bo Wen, Ditao Niu, Anbang Li, Bingbing Guo, Jiyuan Yu, Yao Lv, Alessio Fumagalli, and Marco Berardi. "Optimization of Annual Total Cost for Concrete Frame Beams Based on Carbon Pricing and Service Life". Submitted to Building and Environment. 2025.

[S1] Enrico Ballini, Marco Gambarini, Alessio Fumagalli, Luca Formaggia, Anna Scotti, and Paolo Zunino. "Model reduction of parametric ordinary differential equations via autoencoders: structure-preserving latent dynamics and convergence analysis". Submitted to Mathematics in Engineering. 2025.

Open-source software development

2022, Feb. – Core developer of *PyGeoN: a Python package for Geo-Numerics*. PyGeoN is developed by the Geosciences & Protection of Land and Water Resources group at MOX laboratory, Politecnico di Milano, Italy. See http://github.com/compgeo-mox/pygeon.

2017, May – 2022, Feb. Core developer of *PorePy: A Simulation Tool for Fractured and Deformable Porous Media written in Python*. PorePy is developed by the Porous Media Group at the University of Bergen, Norway. See http://github.com/pmgbergen/porepy.

2010, Jan. – 2013, Feb. Member of the administrative board and developer community of the parallel finite element library *LifeV*. LifeV is developed by the groups: CMCS (École polytechnique fédérale de Lausanne - EPFL, Switzerland), E(CM)2 (Emory University, USA), MOX (Politecnico di Milano, Italy), REO and ESTIME (Institut national de recherche en informatique et en automatique - INRIA, France). See www.lifev.org and https://github.com/lifev/lifev.

Editorial activities

2019 Alessio Fumagalli, Inga Berre, Luca Formaggia, Eirik Keilegavlen, and Anna Scotti, eds. *Numerical Methods for Processes in Fractures Porous Media*. Lecture Notes in Geosystems Mathematics and Computing. In production. Springer, 2019.

2018, Mar. – Editor of the journal GEM – International Journal on Geomathematics, Springer.

2017, Ott. – 2018, Feb. Corresponding Guest Editor for the topical collection "Numerical methods for processes in fractured porous media" of the journal GEM – International Journal on Geomathematics, Springer. Co-Guest Editors Anna Scotti, Luca Formaggia, Inga Berre, Eirik Keilegavlen. 12 papers published. `[link]`.

Educational activities

Teaching activities

13. 3-11 Nov. 2025: lecturer of the master course *Modeling and Simulation of Fault Stability in Subsurface Fluid Injection*, School of Civil Engineering, Xi'an University of Architecture & Technology, China.

12. A.Y. 2023-2024: lecturer of the undergraduate course *Curves and Surfaces for the Design*, Product Design, Politecnico di Milano.

11. 13-21 Dec. 2023: lecturer of the master course *Numerical simulation methods in fractured porous media for seepage flow*, School of Civil Engineering, Xi'an University of Architecture & Technology, China.

10. A.Y. 2023-2024, A.Y. 2024-2025, A.Y. 2025-2026: lecturer of the master course *Numerical methods for the geosciences*, Department of Mathematics, Politecnico di Milano. In collaboration with Anna Scotti.

9. A.Y. 2021-2022: lecturer of the Ph.D. course *Numerical methods for the geosciences*, Department of Mathematics, Politecnico di Milano. In collaboration with Anna Scotti.

8. A.Y. 2020-2021, A.Y. 2021-2022, A.Y. 2022-2023, A.Y. 2023-2024, A.Y. 2024-2025, A.Y. 2025-2026: lecturer of the undergraduate course *Analytical and numerical methods for engineer*, Energy Engineer, Politecnico di Milano.

7. A.Y. 2020-2021: lecturer of the Ph.D. course *Models and methods for simulations and hydro-mechanical coupling*, Department of Mathematics, Politecnico di Milano.

6. A.Y. 2019-2020, A.Y. 2020-2021, A.Y. 2021-2022, A.Y. 2022-2023, A.Y. 2023-2024, A.Y. 2024-2025, A.Y. 2025-2026: lecturer of the undergraduate course *Curves and Surfaces for the Design*, Communication Design, Politecnico di Milano.

5. A.Y. 2019-2020: lecturer of the graduate course *Functional analysis and numerics for PDEs*, Department of Energy, Politecnico di Milano.

4. A.Y. 2018-2019: lecturer of the Ph.D. course *Models and methods for simulations and hydro-mechanical coupling*, Department of Mathematics, Politecnico di Torino.

3. A.Y. 2018-2019: assistant lecturer for the graduate course *Numerical modeling*, Mechanical Engineering, Politecnico di Torino. Lecturer Claudio Canuto.

2. A.Y. 2017-2018: lecturer for the graduate and Ph.D. course *Functional analysis*, Department of Mathematics, University of Bergen.

1. A.Y. 2017-2018: lecturer for the graduate and Ph.D. course *Flow in Porous Media*, Department of Mathematics, University of Bergen. In collaboration with Florin Adrian Radu.

PhD student advising

2. Enrico Ballini. Advisor: Luca Formaggia, Co-advisor: Alessio Fumagalli. Politecnico di Milano, Nov. 2024.

1. Lorenzo Panzeri. Advisor: Laura Longoni, Co-advisor: Alessio Fumagalli. Politecnico di Milano, Nov. 2025.

Student advising

10. Michela De Gabriele. "Modeling temperature-driven fluid flow in porous media with Mixed and Finite Volume method". Advisor: Alessio Fumagalli. Master Thesis. Politecnico di Milano, Oct. 2024.

9. Chiara Giovannini. "Predicting nonlinear-flow regions in highly heterogeneous porous media using adaptive constitutive laws and neural networks". Advisor: Alessio Fumagalli. Co-Advisor: Francesco S. Patacchini. Master Thesis. Politecnico di Milano, June 2024.

8. Camilla Crippa. "A Model for Meltwater Infiltration and Refreezing in Snow under Non-Isothermal Conditions". Advisor: Alessio Fumagalli. Co-advisor: Anna Scotti. Master Thesis. Politecnico di Milano, June 2024.

7. Federico Luca Facchinetti. "Numerical simulations of the Water Table Evolution in a Darcy-Richards system". Advisor: Alessio Fumagalli. Co-advisor: Anna Scotti. Master Thesis. Politecnico di Milano, Dec. 2023.

6. Arash Andrea Roknian. "Free convection in fractured porous media: a numerical study". Advisor: Anna Scotti. Co-advisor: Alessio Fumagalli. Master Thesis. Politecnico di Milano, Dec. 2023.

5. Alessandra Marelli. "Transport of Matter in Discrete Fracture Networks". Advisor: Alessio Fumagalli. Co-advisor: Michel Kern, Géraldine Pichot. Master Thesis. Politecnico di Milano, Sept. 2023.

4. Martin Sandanger Dugstad. "Upscaling on Fracture Flow Models". Advisor: Kundan Kumar. Co-advisor: Alessio Fumagalli. Master Thesis. University of Bergen, June 2017.

3. Marco Del Pra. "Mixed and extended finite elements for flow in fractured porous media". Advisor: Lourenço Beirão Da Veiga, Luca Formaggia. Co-advisor: Anna Scotti, Alessio Fumagalli. Master Thesis. Università degli Studi di Milano, Feb. 2015.

2. Alberto Ferroni. "Numerical Simulation of the Darcy's Problem on Surfaces in $\mathbb{R}^3$". Advisor: Luca Formaggia. Co-advisor: Alessio Fumagalli. Master Thesis. Politecnico di Milano, July 2013.

1. Guido Iori. "Una metodologia XFEM per problemi ellittici 3D con superfici di discontinuità". Advisor: Luca Formaggia. Co-advisor: Alessio Fumagalli. Master Thesis. Politecnico di Milano, Dec. 2011.

Pedagogical training

1. A.Y. 2017-2018: attending the course *Hot Moments in Teaching and Learning: Handling Conflict or Tension in the Classroom and Supervision Situations*, Program for University Pedagogy, Faculty of Psychology, University of Bergen. Lecturer Yael Harlap. 18 hours.

Participation to conferences, workshops and seminars

Organization

20. Member of the scientific and organizing committee of the workshop *Mathematics for planet Earth* (M4E) 2024. Politecnico di Milano, Italy. 11–12 Nov. 2024. Web site `www.mate.polimi.it/events/M4E24`.

19. Minisymposium title *Theoretical and numerical advances for mixed-dimensional 3d-1d coupling* at the Seventh Chilean Workshop on Numerical Analysis of Partial Differential Equations (WONAPDE 2024), 4 participants. Universidad de Concepción, Concepción, Chile. 15–19 Jan. 2024. Co-organizers Luca Formaggia and Miroslav Kuchta.

18. Minisymposium title *Theoretical and numerical advances for mixed-dimensional 3d-1d coupling* at the SIAM Mathematical & Computational Issues on Geosciences (SIAM-GS), 8 participants. University of Bergen, Bergen, Norvegia. 19–22 Jun. 2023. Co-organizer Stefano Scialò.

17. Minisymposium title *Advances in polytopal methods for multiphysics problems* at the European Conference on Numerical Mathematics and Advanced Applications (ENUMATH), 12 participants. Lisbon, Portugal. 4–8 Sep. 2023. Co-organizers Paola Francesca Antonietti, Ivan Fumagalli, Daniele Prada.

16. Minisymposium title *Advances in solution strategies for physical processes in porous media with complex geometries* at the 8th European Congress on Computational Methods in Applied Sciences and Engineering (ECCOMAS), 10 participants. Oslo, Norway. 5–9 Jun. 2022. Co-organizer Elyes Ahmed.

15. Minisymposium title *New numerical tools for poro-fractured media simulations* at Società Italiana per la Matematica Applicata e Industriale (SIMAI) Biannual Congress, 8 participants. Università di Parma, Parma, Italy. 30 Aug.–2 Sep. 2021. Co-organizer Stefano Scialò.

14. Minisymposium title *Non-Conforming and Fast Approximations for Complex Processes in Fractured Porous Media* at SIAM Mathematical & Computational Issues on Geosciences (SIAM-GS) 2021, 5 participants. Politecnico di Milano, Milan, Italy (Held Online). 21–24 Jun. 2021. Co-organizers Rene de Borst.

13. Member of the local organizing committee of the conference *SIAM Mathematical & Computational Issues on Geosciences* (SIAM-GS) 2021. Politecnico di Milano, Milan, Italy (Held Online). 21–24 Jun. 2021. Web site `siam.org/conferences/cm/conference/gs21`.

12. Minisymposium title *Verification benchmarks for single-phase flow in three-dimensional fractured porous media* at SIAM Mathematical & Computational Issues on Geosciences (SIAM-GS) 2019, 8 participants. Houston Marriott Westchase, Houston, Texas, USA. 11–14 Mar. 2019. Co-organizers Inga Berre, Wietse M. Boon, Bernd Flemisch, Dennis Gläser, Eirik Keilegavlen, Anna Scotti, Ivar Stefansson, Alexandru Tatomir.

11. Minisymposium title *Advanced models and methods for underground flows in complex geometries with applications* at SIAM Mathematical & Computational Issues on Geosciences (SIAM-GS) 2019, 9 participants. Houston Marriott Westchase, Houston, Texas, USA. 11–14 Mar. 2019. Co-organizers Anna Scotti, Stefano Scialò.

10. Minisymposium title *Numerical methods for processes in fractured media* at 10^{th} International Conference on Porous Media of the International Society of Porous Media (InterPore). 4 participants. Ernest N. Morial Convention Center, New Orleans, Louisiana, USA. 14–17 May 2018. Co-organizers Géraldine Pichot, Elyes Ahmed.

9. Minisymposium title *Mathematical aspects for flows in fractured porous media* at European Conference on Numerical Mathematics and Advanced Applications (ENUMATH) 2017. 4 participants. University of Bergen, Voss, Norway. 19–21 Sep. 2017. Co-organizer Eirik Keilegavlen.

8. Minisymposium title *Numerical methods for the characterization of geothermal reservoirs* at SIAM Mathematical & Computational Issues on Geosciences (SIAM-GS) 2017, 10 participants. University of Erlangen, Erlangen, Germany. 11–14 Sep. 2017. Co-organizers Luca Formaggia, Eirik Keilegavlen, Anna Scotti.

7. Minisymposium title *Enriched methods for flow and mechanics in heterogeneous porous media* at eXtended Discretization MethodS (XDMS) 2017. 13 participants. University of Umeå, Umeå, Sweden. 19–21 Jun. 2017. Co-organizers Stefano Berrone, Stefano Scialò, Stefano Zonca.

6. Chair organizer of the workshop *Modeling and Benchmarking of Fractured Porous Media: Flow, Transport and Deformation (MBFPM)- 2017*. 43 participants. University of Bergen, Bergen, Norway. 8–9 Jun. 2017. Co-organizers: Inga Berre, Wietse Boon, Bernd Flemisch, Ivar Stefansson, Anna Scotti, Alexandru Tatomir. Web site `www.uib.no/en/mbfpm2017`.

5. Member of the organizing committee of the conference *eXtended Discretization MethodS* (XDMS) 2015. 112 participants. University of Ferrara, Ferrara, Italy. 9–11 Sep. 2015. Web site `x-dms2015.sciencesconf.org`.

4. Minisymposium title *Enriched methods for flow and mechanics in heterogeneous porous media* at eXtended Discretization MethodS (XDMS) 2015. 9 participants. University of Ferrara, Ferrara, Italy. 9–11 Sep. 2015. Co-organizers Stefano Berrone, Oliver Sander, Anna Scotti.

3. Minisymposium title *Advances in numerical methods for complex fractured-porous media* SIAM Mathematical & Computational Issues on Geosciences (SIAM-GS) 2015, 6 participants. Stanford University, Stanford, California USA. 29 Jun.–2 Jul. 2015. Co-organizers Stefano Berrone, Sandra Pieraccini, Anna Scotti.

2. Minisymposium title *Modeling and Numerical Issues for fractured-porous media* at SIAM Annual Meeting 2014, 12 participants. The Palmer House, Chicago, Illinois, USA. 7–11 Jul. 2014. Co-organizer Géraldine Pichot.

1. Minisymposium title *Numerical resolution of PDE: the potentiality of the LifeV library* at Società Italiana per la Matematica Applicata e Industriale (SIMAI) Biannual Congress, 4 participants. Politecnico di Torino, Turin, Italy. 25–26 Jun. 2012. Co-organizer Franco Dassi.

Oral presentations

63. *Reduced-order modeling techniques for subsurface simulations*. Online seminar at Applied Mathematics and Computation Seminars, Department of Mathematics, Oregon State University. 16 Jan. 2026. Co-authors Enrico Ballini, Wietse M. Boon, Luca Formaggia, Nicola R. Franco, Anna Scotti, Paolo Zunino. Invited.

62. *Model Reduction Methods for Efficient Simulation of Faulted Poroelastic Media*. Seminar at Xi'an University of Architecture & Technology, China. 6 Nov. 2025. Co-authors Enrico Ballini, Alberto Cominelli, Laura Dovera, Luca Formaggia, Anna Scotti, Paolo Zunino. Invited.

61. *A Mixed-Dimensional Modeling Framework for Near-Surface Direct Current Monitoring*. Seminar at Xi'an University of Architecture & Technology, China. 4 Nov. 2025. Co-authors Diego Arosio, Luca Formaggia, Laura Longoni, Lorenzo Panzeri, Monica Papini, Anna Scotti. Invited.

60. *Reduced models techniques for subsurface simulations*. Seminar at Mittag-Leffler Institute, The Royal Swedish Academy of Sciences, Sweden. 15 Oct. 2025. Co-authors Wietse M. Boon, Nicola R. Franco, Paolo Zunino. Invited.

59. *A mixed-dimensional model for direct current near-surface monitoring*. Seminar at Nottingham University, United Kingdom. 9 Jul. 2025. Co-authors Diego Arosio, Luca Formaggia, Laura Longoni, Lorenzo Panzeri, Monica Papini, Anna Scotti.

58. *Reduced order modeling for poroelastic media with faults*. Numerical analysis, porous media and water resources: a fruitful contamination (INTRUSION 2025). Bari, Italy. 30 Jun.–2 Jul. 2025. Co-authors Enrico Ballini, Alberto Cominelli, Laura Dovera, Luca Formaggia, Anna Scotti, Paolo Zunino.

57. *Reduced order modeling for a poroelastic media with faults*. 15^{th} International Conference on Large-Scale Scientific Computations. Sozopol, Bulgaria. 16–20 Jun. 2025. Co-authors Enrico Ballini, Alberto Cominelli, Laura Dovera, Luca Formaggia, Anna Scotti, Paolo Zunino. Invited in minisymposium.

56. *A cylindrical axial-symmetric virtual element method for acoustic wave propagation*. XI International Conference on Coupled Problems in Science and Engineering. Villasimius, Sardinia, Italy. 25–28 May 2025. Co-authors Franco Dassi, Alessio Fumagalli, Ilario Mazzieri, Giuseppe Vacca. Invited in minisymposium.

55. *A mixed-dimensional model for direct current near-surface monitoring*. Bergen Conference on Modeling and Simulation of Coupled Subsurface Dynamics, University of Bergen, Norway. 13–15 May 2025. Co-authors Diego Arosio, Luca Formaggia, Laura Longoni, Lorenzo Panzeri, Monica Papini, Anna Scotti. Invited.

54. *A multipoint stress mixed finite element method for the linear Cosserat equations*. Workshop NMT4PMG, Università degli Studi di Milano, Milan, Italy. 5 Feb. 2025. Co-authors Wietse M. Boon, Jan M. Nordbotten, Ivan Yotov. Invited.

53. *Solution strategies to solve poroelasticity for complex grids*. The 9th European Congress on Computational Methods in Applied Sciences and Engineering (ECCOMAS). Lisbon, Portugal. 3–7 Jun. 2024. Co-author Wietse M. Boon. Invited in minisymposium.

52. *Reduced models techniques for subsurface simulations*. Seminar at University of Bergen, Norway. 30 Apr. 2024. Co-authors Wietse M. Boon, Nicola R. Franco, Paolo Zunino. Invited.

51. *A mixed-dimensional model for simulating direct current with high resistivity liner*. Seventh Chilean Workshop on Numerical Analysis of Partial Differential Equations (WONAPDE 2024). Universidad de Concepción, Concepción, Chile. 15–19 Jan. 2024. Co-authors Diego Arosio, Luca Formaggia, Lorenzo Panzeri, Anna Scotti.

50. *A mixed-dimensional model for direct current simulations with an immersed high resistivity liner*. Seminar at Chongqing University, China. 19 Dec. 2023. Co-authors Diego Arosio, Luca Formaggia, Lorenzo Panzeri, Anna Scotti. Invited.

49. *A Machine Learning Technique for the Darcy Problem in a Fractured Porous Media that Ensure Local Mass Conservation*. Seminar at Xi'an University of Architecture & Technology, China. 18 Dec. 2023. Co-authors Wietse M. Boon, Nicola R. Franco, Paolo Zunino. Invited.

48. *A machine learning approach that ensure local mass conservation for single-phase flow in fractured porous media*. Numerical analysis, porous media and water resources: a fruitful contamination (INTRUSION 2023). Bari, Italy. 3–5 Jul. 2023. Co-authors Wietse M. Boon, Nicola R. Franco, Paolo Zunino. Invited speaker.

47. *Mixed FEM for rotation-based poroelasticity*. SIAM Mathematical & Computational Issues on Geosciences (GS23). Bergen, Norway. 19–22 Jun. 2023. Co-authors Wietse M. Boon, Anna Scotti. Invited in minisymposium.

46. *A machine learning technique for the Darcy problem in a fractured porous media that ensure local mass conservation*. 14^{th} International Conference on Large-Scale Scientific Computations. Sozopol, Bulgaria. 5–9 Jun. 2023. Co-authors Wietse M. Boon, Nicola R. Franco, Paolo Zunino. Invited in minisymposium.

45. *Multipoint mixed FEM for rotation-based poroelasticity with preconditioners*. 15^{th} International Conference on Porous Media of the International Society of Porous Media (InterPore). Edinburgh, United Kingdom. 22–25 May. 2023 Co-authors Wietse M. Boon, Anna Scotti. Invited in minisymposium.

44. *A mixed-dimensional model for direct current simulations with an immersed high resistivity liner*. Seminar at Hasselt University, Belgium. 29 Sep. 2022. Co-authors Diego Arosio, Luca Formaggia, Lorenzo Panzeri, Anna Scotti. Invited.

43. *Finite volume discretizations of porous media flow with two-scale fractures*. XXIV International Conference on Computational Methods in Water Resources (CMWR). Gdańsk, Poland. 19–23 Jun. 2022. Co-author Eirik Keilegavlen. Invited in minisymposium.

42. *Virtual element methods for domains with curved geometry*. Seminar at SINTEF Digital, Oslo. 10 Jun. 2022. Co-authors Franco Dassi, Davide Losapio, Ilario Mazzieri, Stefano Scialò, Anna Scotti, Giuseppe Vacca. Organizer Elyes Ahmed. Invited.

41. *A mixed-dimensional model for reactive transport: modeling and computational aspects*. The 8th European Congress on Computational Methods in Applied Sciences and Engineering (ECCOMAS). Oslo, Norway. 5–9 Jun. 2022. Co-authors Luca Formaggia, Anna Scotti. Invited in minisymposium.

40. *Uncertainty quantification for reactive transport in fractured porous media*. Fractured media: numerical methods for fluid flow and mechanics (FRAME2020+2). Politecnico di Torino, Turin, Italy. 17–20 May 2022. Co-authors Michele Botti, Anna Scotti.

39. *Uncertainty quantification for numerical simulations in carbon mineralization*. Advances in the SImulation of reactive flow and TRAnsport in porous Media (SITRAM21). Inria Paris Research Centre, Paris, France. 8–10 Dic. 2021. Co-authors Michele Botti, Simone Ripamonti, Arash A. Roknian, Anna Scotti.

38. *Virtual element methods for domains with curved geometry*. SimRace 2021 on Numerical Methods and High Performance Computing for industrial applications. IFP Energies nouvelles, Rueil-Malmaison, France. 2–3 Dic. 2021. Co-authors Franco Dassi, Davide Losapio, Ilario Mazzieri, Stefano Scialò, Anna Scotti, Giuseppe Vacca. Invited.

37. *The mixed virtual element method for grids with curved interfaces in single-phase flow problems*. SPE Reservoir Simulation Conference. On-demand. 26 Oct.–1 Nov. 2021. Co-authors Franco Dassi, Davide Losapio, Stefano Scialò, Anna Scotti, Giuseppe Vacca.

36. *Performance of the mixed Virtual Element Method on complex grids for porous media flow*. Società Italiana per la Matematica Applicata e Industriale (SIMAI) Biannual Congress. Università di Parma, Parma, Italy. 30 Aug.–2 Sep. 2021. Co-authors Franco Dassi, Luca Formaggia, Anna Scotti, Giuseppe Vacca. Invited in minisymposium.

35. *A Virtual Element Method for the wave equation on curved edges in two dimensions*. SIAM Mathematical & Computational Issues on Geosciences (SIAM-GS) 2021. Milan, Italy (Held Online). 21–24 Jun. 2021. Co-authors Franco Dassi, Ilario Mazzieri, Anna Scotti, Giuseppe Vacca. Invited in minisymposium.

34. *Model adaptation in a discrete fracture network: existence of solutions and numerical strategies* Seminar at Geoscience Team, Technische Universiteit Delft, Netherlands (Held Online). 3 Mar. 2021. Co-author Francesco Saverio Patacchini. Organizer Yuhang Wang. Invited.

33. *Mixed-dimensional models for reactive flow in fractured porous media*. Seminar at Porous Media Group, University of Bergen, Norway (Held Online). 19 Feb. 2020. Co-authors Anna Scotti, Luca Formaggia. Organizer Shin Irgens Banshoya.

32. *A multilayer model for reactive flow in fractured porous media*. 12^{th} International Conference on Porous Media of the International Society of Porous Media (InterPore). Qingdao, China (Held Online). 31 Aug.–4 Sep. 2020 Co-authors Anna Scotti, Luca Formaggia.

31. *Mixed-virtual element methods for discrete fracture matrix models. An application to reactive transport*. Finite Volumes for Complex Applications IX, Bergen, Norway (Held Online). 15–19 Jun. 2020. Invited speaker.

30. *A multilayer model for reactive flow in fractured porous media*. Advances in the SImulation of reactive flow and TRAnsport in porous Media. University of Pau & Adour Region, Pau, France. 2–3 Dec. 2019. Co-author Anna Scotti.

29. *Flexible discretizations for mixed-dimensional Darcy-type flows in fractured porous media*. Seminar at Faculty of Mechatronics, Informatics and Interdisciplinary Studies, Technical University of Liberec, Czech Republic. 12 Jun. 2019. Organizer Jan Březina. Invited.

28. *Verification benchmarks for single-phase flow in three-dimensional fractured porous media*. SIAM Mathematical & Computational Issues on Geosciences (SIAM-GS) 2019. Houston Marriott Westchase, Houston, Texas, USA. 11–14 Mar. 2019. Co-authors Inga Berre, Wietse M. Boon, Bernd Flemisch, Dennis Gläser, Eirik Keilegavlen, Anna Scotti, Ivar Stefansson, Alexandru Tatomir.

27. *Mixed-dimensional partial differential equations for flow in fractured porous media, modeling and numerical schemes*. 12^{th} Workshop On Mathematical Modeling of Environmental and Life Sciences Problems. University Ovidius of Constanţa, Constanţa, Romania. 24–28 Oct. 2018. Invited speaker.

26. *Numerical methods for embedded interfaces: applications to geoscience*. Società Italiana per la Matematica Applicata e Industriale (SIMAI) Biannual Congress. Sapienza Università di Roma, Rome, Italy. 2–6 Jul. 2018. Keynote speaker invited in minisymposium.

25. *A general framework for heterogeneous discretizations in mixed-dimensional single-phase flow*. Società Italiana per la Matematica Applicata e Industriale (SIMAI) Biannual Congress. Sapienza Università di Roma, Rome, Italy. 2–6 Jul. 2018. Co-authors Wietse Boon, Eirik Keilegavlen, Jan M. Nordbotten. Invited in minisymposium.

24. *Flexible discretizations for mixed-dimensional single-phase flow in fractured porous media*. Seminar at Department of Mathematics of the University of Padua, Padua, Italy. 2 Mar. 2018. Organizer Mario Putti. Invited.

23. *Dual virtual element method for fractured geothermal systems*. European Conference on Numerical Mathematics and Advanced Applications (ENUMATH) 2016. University of Bergen, Voss, Norway. 25–29 Sep. 2017. Co-author Eirik Keilegavlen, Pål Næverlid Sævik. Invited in minisymposium.

22. *An integrated mathematical-geological workflow for fractured geothermal system in metamorphic rocks*. SIAM Mathematical & Computational Issues on Geosciences (SIAM-GS) 2017. University of Erlangen, Erlangen, Germany. 11–14 Sep. 2017. Co-author Eirik Keilegavlen. Invited in minisymposium.

21. *Dual virtual element method to simulate geothermal energy extraction on realistic geologies*. Bergen-Budapest Workshop. Western Norway University of Applied Sciences, Bergen, Norway. 29–30 May 2017. Co-author Eirik Keilegavlen. Invited.

20. *A mathematical and geological approach for fractured geothermal system*. SIAM Conference on Computational Science and Engineering (SIAM-CSE). Hilton Atlanta, Atlanta, Georgia, USA. 27 Feb.–3 Mar. 2017. Co-author Eirik Keilegavlen. Invited in minisymposium.

19. *Integrated flow simulation and outcrop interpretation in fractured geothermal systems*. Seminar at Department of Applied Mathematics in SINTEF, Oslo, Norway. 21 Sep. 2016. Co-author Eirik Keilegavlen. Organizer Xavier Raynaud. Invited.

18. *An integrated geological and mathematical framework for geothermal reservoirs. from outcrops to a VEM approximation*. Seminar at Department of Mathematics of University of Milano-Bicocca, Milan, Italy. 2 Sep. 2016. Co-author Eirik Keilegavlen. Organizer Franco Dassi. Invited.

17. *An integrated geological and mathematical framework for geothermal reservoirs*. Flow & Transport in Permeable Media, Gordon Research Seminar. PGA Catalunya Business and Convention, Girona, Spain. 30–31 Jul. 2016. Co-author Eirik Keilegavlen.

16. *An integrated geological and mathematical framework for geothermal reservoirs*. 8^{th} International Conference on Porous Media of the International Society of Porous Media (InterPore). Hilton Cincinnati Netherland Plaza, Cincinnati, Ohio, USA. 9–12 May 2016. Co-author Eirik Keilegavlen. Invited in minisymposium.

15. *Non-matching schemes for upscaling in fractured porous media*. eXtended Discretization MethodS (XDMS) 2015. University of Ferrara, Ferrara, Italy. 9–11 Sep. 2015. Co-authors Anna Scotti, Stefano Zonca.

14. *Upscaling techniques for highly fractured porous media with non-matching discretization*. SIAM Mathematical & Computational Issues on Geosciences (SIAM-GS) 2015. Stanford University, Stanford, California USA. 29 Jun.–2 Jul. 2015. Co-authors Paola Panfili, Luca Pasquale, Stefano Zonca.

13. *An efficient upscaling technique for highly fractured reservoir*. International Conference on Approximation Methods and Numerical Modelling in Environment and Natural Resources (MAMERN) 2015. University of Pau, France. 1–5 Jun. 2015. Co-authors Paola Panfili, Luca Pasquale, Stefano Zonca. Invited in minisymposium.

12. *A double-layer reduced model for flow in fault zones using hybrid finite volume schemes*. SIAM Annual Meeting 2014. The Palmer House, Chicago, Illinois, USA. 7–11 Jul. 2014. Co-authors Isabelle Faille, Jérôme Jaffré, Jean E. Roberts.

11. *Double-layer reduced model for faults with the hybrid finite volume scheme*. Computational Methods in Water Resources (CMWR). University of Stuttgart, Germany. 10–13 Jun. 2014. Co-authors Isabelle Faille, Jérôme Jaffré, Jean E. Roberts. Invited in minisymposium.

10. *Numerical methods for flows in fractured porous media*. FRACINI first workshop. INRIA Rennes - Bretagne Atlantique, Rennes, France. 28–30 Apr. 2014. Co-authors Luca Formaggia, Anna Scotti. Invited in workshop.

9. *XFEM for heterogeneous porous media with networks of fractures*. XFEM 2013, thematic conference of ECCOMAS. Espace Tête d'Or, Lyon, France. 11–13 Sep. 2013. Co-authors Luca Formaggia, Anna Scotti.

8. *Assessment of an HPC two-phase flow solver in porous media for realistic cases*. SIAM Mathematical & Computational Issues on Geosciences (SIAM-GS) 2013. Department of Mathematics University of Padova, Italy. 17–20 Jun. 2013. Co-authors Antonio Cervone, Luca Formaggia. Invited in minisymposium.

7. *XFEM for Darcy problems with networks of fractures*. Società Italiana per la Matematica Applicata e Industriale (SIMAI) Biannual Congress. Politecnico di Torino, Turin, Italy. 25–26 Jun. 2012. Co-authors Luca Formaggia, Anna Scotti.

6. *Reduced models for intersecting fractures in porous media with non-matching grids*. 4^{th} International Conference on Porous Media of the International Society of Porous Media (InterPore). Purdue University, Lafayette, Indiana, USA. 14–16 May 2012. Co-authors Luca Formaggia, Anna Scotti. Invited in minisymposium.

5. *Modelli ridotti per flussi in mezzi porosi fratturati con griglie di calcolo non conformi*. XIX Congresso dell'Unione Matematica Italiana (UMI). Dipartimento di Matematica dell'Università di Bologna, Bologna, Italy. 12–17 Sep. 2011. Co-author Anna Scotti.

4. *Interface Conditions for Fluid Flow in Porous Media with Reduced Order and Non Matching Fractures*. SIAM Mathematical & Computational Issues on Geosciences. Hilton Long Beach Centre, Long Beach, California, USA. 21–24 Mar. 2011. Co-author Anna Scotti.

3. *Models for oil expulsion and migration in fractured media*. Reduction Strategies for the Simulation of Complex Problems. MOX, Department of Mathematics, Politecnico di Milano, Milan, Italy. 19–21 Jan. 2011. Co-authors Luca Formaggia, Anna Scotti

2. *Darcy solvers*. Second LifeV annual meeting. MOX, Department of Mathematics, Politecnico di Milano, Milan, Italy. 3–4 Jan. 2011.

1. *Computational aspects for oil secondary migration*. Seminar held at INRIA Roquencourt, Paris, France. 16 Sep. 2010. Organizers: Jérôme Jaffré, Michel Kern. Invited.

Poster presentations

7. *Mixed-dimensional MVEM for real fractured geothermal systems*. Dobbiaco summer school - Theory and Practice of the Virtual Element Methods. Dobbiaco, Italy. 17-22 Jun. 2018. Co-author Eirik Keilegavlen.

6. *A mathematical approach for fractured geothermal system*. InterPore Norwegian Chapter, 1^{st} National Workshop on Porous Media. University of Trondheim - NTNU, Trondheim, Norway. 19 Oct. 2017. Co-author Eirik Keilegavlen.

5. *Dual virtual element methods for real fractured geothermal systems*. Modeling and Benchmarking of Fractured Porous Media: Flow, Transport and Deformation - 2017. University of Bergen, Bergen, Norway. 8–9 Jun. 2017. Co-author Eirik Keilegavlen.

4. *Dual virtual element methods for real fractured geothermal systems*. Modeling and Benchmarking of Fractured Porous Media: Flow, Transport and Deformation - 2017. University of Bergen, Bergen, Norway. 8–9 Jun. 2017. Co-author Eirik Keilegavlen.

3. *An integrated geological and mathematical framework for geothermal reservoirs*. Flow & Transport in Permeable Media, Gordon Research Seminar and Gordon Research Conference. PGA Catalunya Business and Convention, Girona, Spain. 30–31 Jul. and 1–5 Aug. 2016. Co-author Eirik Keilegavlen.

2. *LifeV::Geophysics@EuroTUG2012*. European Trilinos user group 2012 (EuroTUG). École Polytechnique Fédérale de Lausanne, Lausanne, Switzerland. 4–6 Jun. 2012. Co-authors Antonio Cervone, Nur Fadel, Guido Iori, Michel Kern.

1. *Reduced models for fractures in porous media with non-matching grids*. 4^{th} International Conference on Porous Media of the International Society of Porous Media (InterPore). Purdue University, Lafayette, Indiana, USA. 14–16 May 2012. Co-authors Luca Formaggia, Anna Scotti.

Milano, Italy, 19 May 2026

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