

# ADRIAN MOURE ROSENDE

## CONTACT INFORMATION

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Address: 154 Willow Ave, Somerville, MA, 02144, USA  
Phone: +1 (765) 637-5240  
Email: a.moure.rosende@gmail.com  
adrian.moure.rosende@edengeopower.com

## RESEARCH INTERESTS

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Computational mechanics; Biomechanics; Phase-field modeling; Isogeometric Analysis; Large-Scale computing; Cellular motility; Mechanisms of tumor growth; Coupling flow and fracture dynamics; Multiphase flow; Snow hydrology; Soil carbon emissions; Geophysics; Flow in porous media; Electro-Thermo-Hydro-Mechanical coupling in geomechanics;

## EDUCATION

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- Sept 2014 – Nov 2017 **Ph.D., Applied Mathematics Department** in the School of Civil Engineering, Universidade da Coruña, Spain.  
Thesis: “Phase-field modeling and isogeometric analysis of cell crawling.”  
Advisor: Prof. Hector Gomez.  
Summa Cum Laude.  
International Doctor.
- Sept 2013 – Jun 2014 **M.S. in Research in Civil Engineering.** Civil Engineering School, Universidade da Coruña, Spain.
- Sept 2005 – Sept 2011 **Coupled B.S and M.S. in Civil Engineering.** Civil Engineering School, Universidad Politécnica de Madrid, Spain.  
Class rank 1.

## EXPERIENCE

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- Feb 2024 – Present **Computational R&D Geoscientist** at Eden Geopower, Somerville, MA, USA.  
Supervisors: Ehsan Haghighat, Rafael Villamor-Lora.
- Nov 2023 – Feb 2024 **Research Scientist** in the Department of Mechanical and Civil Engineering, California Institute of Technology, USA.  
Supervisor: Prof. Ruby Fu.
- Mar 2021 – Oct 2023 **Post-Doctoral Scholar Research Associate** in the Department of Mechanical and Civil Engineering, California Institute of Technology, USA.  
Supervisor: Prof. Ruby Fu.

- Jan 2018 – Mar 2021 **Post-Doctoral Research Associate** in the School of Mechanical Engineering, Purdue University, USA.  
Supervisor: Prof. Hector Gomez.
- May 2017 – Sept 2017 **Research Scholar** at School of Mechanical Engineering, Purdue University (under the supervision of Prof. Hector Gomez).
- Nov 2013 – Nov 2017 **Predoctoral Researcher** in the School of Civil Engineering, Universidade da Coruña, Spain.  
Advisor: Prof. Hector Gomez.

## JOURNAL ARTICLES

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13. A.S. Paspunurwar, **A. Moure**, H. Gomez. Dynamic cluster field modeling of collective chemotaxis. *Sci. Rep.*, 14, 2024.
12. **A. Moure**, X. Fu. A phase-field model for wet snow metamorphism. *Cryst. Growth Des.*, 24(19), 2024.
11. A. Srinivasan, **A. Moure**, H. Gomez. Computational modeling of flow-mediated angiogenesis: Stokes-Darcy flow on a growing vessel network. *Eng. Comput.*, 2023.
10. **A. Moure**, N. Jones, J. Pawlak, C. Meyer, X. Fu. A thermodynamic nonequilibrium model for preferential infiltration and refreezing of melt in snow. *Water Resour. Res.*, 59, 2023.
9. **A. Moure**, G. Vilanova, H. Gomez. Inverting angiogenesis with interstitial flow and chemokine matrix-binding affinity. *Sci. Rep.*, 12, 4237, 2022.
8. E. Haghighat, M. Raissi, **A. Moure**, H. Gomez, R. Juanes. A physics-informed deep learning framework for inversion and surrogate modeling in solid mechanics. *Comput. Methods Appl. Mech. Eng.*, 379, 2021.
7. **A. Moure**, H. Gomez. Phase-field modeling of individual and collective cell migration. *Arch. Computat. Methods Eng.*, 28, 311–344, 2021.
6. **A. Moure**, H. Gomez. Influence of myosin activity and mechanical impact on keratocyte polarization. *Soft Matter*, 16, 5177–5194, 2020.
5. **A. Moure**, H. Gomez. Dual role of the nucleus in cell migration on planar substrates. *Biomech. Model Mechanobiol.*, 19, 1491–1508, 2020.
4. H. Gomez, M. Bures, **A. Moure**. A review on computational modelling of phase-transition problems. *Philosophical Transactions of the Royal Society A*, 377, 20180203, 2019.
3. **A. Moure**, H. Gomez. Three-dimensional simulation of obstacle-mediated chemotaxis. *Biomech. Model Mechanobiol.*, 17, 1243–1268, 2018.
2. **A. Moure**, H. Gomez. Phase-field model of cellular migration: Three-dimensional simulations in fibrous networks, *Comput. Methods Appl. Mech. Eng.*, 320, 162–197, 2017.
1. **A. Moure**, H. Gomez. Computational model for amoeboid motion: coupling membrane and cytosol dynamics, *Phys. Rev. E*, 94, 042423, 2016.

## AWARDS AND HONORS

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- 2019 Outstanding PhD Thesis Award in Civil Engineering, Universidade da Coruña.
- 2017 SEMNI award to the Best PhD Thesis 2017.
- 2017 SeMA candidate for the ECCOMAS award to the Best PhD Thesis 2017 on Computational Methods in Applied Sciences and Engineering.
- 2012 Premio Escalona Award ranked 1 of its class.
- 2012 FCC Construcción Award ranked 1 of its class.
- 2012 Fundación Agustín de Betancourt Award ranked 1 of its class.

## CONFERENCES

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- 19. A. Moure, X. Fu. "Pore-scale three-phase model for water phase transitions: impact of melt film generation on wet snow metamorphism" (presentation), *76th Annual Meeting of the APS Division of Fluid Dynamics*, Washington, DC (USA), November 19-21, 2023.
- 18. A. Moure, X. Fu. "Pore-scale modeling of wet snow metamorphism" (presentation), *15th International Conference on the Physics and Chemistry of Ice*, Sapporo, Japan, September 3-8, 2023.
- 17. A. Moure, N. Jones, X. Fu. "Multiphase model for preferential infiltration and refreezing of meltwater in snow" (presentation), *James K. Knowles Lectures and Caltech Solid Mechanics Symposium*, Pasadena, California (USA), May 19, 2023.
- 16. A. Moure, N. Jones, J. Pawlak, C. Meyer, X. Fu. "Preferential meltwater infiltration and refreezing: a multiphase model" (poster), *AGU Fall Meeting 2022*, Chicago, Illinois (USA), December 12-16, 2022.
- 15. A. Moure, N. Jones, J. Pawlak, C. Meyer, X. Fu. "Preferential meltwater infiltration and refreezing: a multiphase model" (presentation), *4th California Geophysical Fluid Dynamics Meeting*, Pasadena, California (USA), August 18-19, 2022.
- 14. A. Moure, N. Jones, J. Pawlak, C. Meyer, X. Fu. "Nonequilibrium thermodynamics of meltwater infiltration" (poster), *Flow and Transport in Permeable Media (GRC)*, Les Diablerets, Switzerland, July 17-22, 2022.
- 13. A. Moure, N. Jones, J. Pawlak, C. Meyer, X. Fu. "A thermodynamic nonequilibrium model for meltwater infiltration and refreezing" (presentation), *Flow and Transport in Permeable Media (GRS)*, Les Diablerets, Switzerland, July 16-17, 2022.
- 12. A. Moure, X. Fu. "Dry and wet snow metamorphism: a phase-field model of pore-scale phase change dynamics" (presentation), *So Cal Fluids XV*, Los Angeles, California (USA), April 23, 2022.

11. A. Moure, X. Fu. "Pore-scale modeling of wet snow metamorphism" (presentation), *AGU Fall Meeting 2021*, New Orleans, Louisiana (USA), December 13-17, 2021.
10. A. Moure, H. Gomez. "A computational model to unveil the role of the nucleus in 2D cell migration" (poster), *63rd Annual Meeting of the Biophysical Society*, Baltimore, Maryland (USA), March 2-6, 2019.
9. A. Moure, H. Gomez. "Three-dimensional simulation of obstacle-mediated chemotaxis" (presentation), *2nd Toledo CellulART Meeting*, Toledo, Ohio, (USA), September 14, 2018.
8. A. Moure, H. Gomez. "Three-dimensional simulation of obstacle-mediated chemotaxis" (presentation), *13th World Congress on Computational Mechanics (WCCM XIII)*, New York City, New York (USA), July 22-27, 2018.
7. A. Moure, H. Gomez. "Phase-field modeling and isogeometric analysis of amoeboid motion: 3D simulation of obstacle-mediated chemotaxis" (presentation), *18th Conference of the Spanish-French School*, Las Palmas de Gran Canaria, Spain, June 25-29, 2018.
6. P. Dominguez-Frojan, A. Moure, H. Gomez. "Isogeometric simulations of glioma growth on precise brain geometries based on the proliferation-invasion-hypoxia-necrosis-angiogenesis model" (poster), *Congress on Numerical Methods in Engineering CMN2017*, Valencia, Spain, July 03-05, 2017.
5. A. Moure, H. Gomez. "Computational modeling of amoeboid motion: *Dictyostelium* in chemotactic environments" (presentation), *5th International Conference on Computational and Mathematical Biomedical Engineering*, Pittsburgh, Pennsylvania (USA), April 10-12, 2017.
4. A. Moure, H. Gomez. "Computational modeling of amoeboid motion: Chemotaxis and free movement in different environments" (presentation), *Mechanobiology across Networks*, Barcelona, Spain, October 6-7, 2016.
3. A. Moure, H. Gomez. "Computational modeling of amoeboid motion: Chemotaxis and free movement in different environments" (presentation), *12th World Congress on Computational Mechanics (WCCM XII)*, Seoul, Republic of Korea, July 24-29, 2016.
2. A. Moure, H. Gomez. "Computational modeling of cellular motility: Chemotaxis and movement in confined environments" (presentation), *21th Congress of the European Society of Biomechanics*, Prague, Czech Republic, July 5-8, 2015.
1. H. Gomez, G. Vilanova, A. Moure. "An overview of our work on modeling and simulation on cancer growth" (presentation), *Kick-off Meeting – Spanish Network of Excellence in Mechanobiology*, Barcelona, Spain, February 24-25, 2015.

## RESEARCH PROJECTS

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| 2024 – Present | Integrated Electro-Hydraulic Fracturing and Real-Time Monitoring for Carbon Negative In-Situ Mining. Advanced Research Projects Agency – Energy (ARPA-E). PI: Wencheng Jin. |
| 2024 – Present | Electro-Hydraulic Fracturing for Enhanced Geothermal Systems. Advanced Research Projects Agency – Energy (ARPA-E). PI: Paris Smalls.  |

- 2023 – 2024 “Predictive modeling of robotic interactions with icy porous analogs under phase change dynamics”. PDRDF - NASA Jet Propulsion Laboratory. PI: Ruby Fu.
- 2022 – 2024 “The Caltech Critical Zone Initiative”. Caltech’s Resnick Sustainability Institute. PI: Ruby Fu.
- 2021 – 2024 “Tracing the fate of water through snow: a cryohydrologic model for meltwater percolation”. Caltech’s Resnick Sustainability Institute. PI: Ruby Fu.
- 2020 – 2021 “Unveiling the role of interstitial flow in angiogenesis through phase-field simulations”. National Science Foundation (NSF). PI: H. Gomez.
- 2012 – 2017 “Modeling and Simulation of Cancer growth (MuSIC)”. European Research Council (ERC). PI: H. Gomez.
- 2014 – 2016 “Computational models of cancer microvasculature: Unveiling the topology and transport capacity of tumor-induced capillary networks”. Ministerio de Economía y Competitividad de España (MINECO). PI: H. Gomez.

## INVITED TALKS

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3. “Multiphase models for snow hydrology: from pore-scale snow metamorphism to Darcy-scale meltwater infiltration”, *Mathematics on Ice Forum*, Webinar, April 3, 2023.
2. “Phase-field modeling and simulation in biomechanics: cell migration and other applications”, *PDE & Applied Math Seminar – UC Riverside*, Riverside, California (USA), May 11, 2022.
1. “Phase-field modeling and simulation in biomechanics: cell migration and other applications”, *Mechanical and Civil Engineering Seminar Series – Caltech*, Pasadena, California (USA), April 1, 2021.

## GRANTS

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- 2017 “Ayudas para estancias predoctorales Inditex-UDC 2017”. Entity: Inditex S.A. €5,115.
- 2005 – 2011 “Becas de Excelencia de la Comunidad de Madrid”. Entity: Comunidad Autónoma de Madrid. €27,000.

## OTHER PUBLICATIONS

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- Book chapter: M. Bures, **A. Moure**, H. Gomez. Computational treatment of interface dynamics via phase-field modeling, *Numerical simulation in physics and engineering: Trends and applications*, Springer, 2021.
- Ph.D. thesis: **A. Moure**. Phase-field modeling and isogeometric analysis of cell crawling, *Ph.D. thesis*, Universidade da Coruña, 2017.

## JOURNAL REVIEWER

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Frontiers in Applied Mathematics and Statistics. Journal of Fluid Mechanics. Scientific Reports.  
Journal of Biomechanical Engineering. Biomechanics and Modeling in Mechanobiology.

## INTERNATIONAL COURSES

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- 2014 “Mechanobiology of cells and tissues: motility and morphogenesis”. International Centre for Mechanical Sciences (CISM), Udine, Italy, June 16-20, 2014.
- 2013 “Phase-field modeling of phase change phenomena”. Instituto de Matemáticas de la Universidad de Sevilla (IMUS), Sevilla, Spain, December 17-19, 2013.

## AFFILIATIONS

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- 2023 – 2024 Member of the American Physical Society (APS).
- 2021 – 2024 Member of the American Geophysical Union (AGU).
- 2019 Member of the Biophysical Society.
- 2015 – 2017 Member of the European Society of Biomechanics (ESB).
- 2014 – 2017 Member of the Group of Numerical Methods in Engineering.

## LANGUAGES

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- Spanish Native.
- Galician Native.
- English C1 level.
- Portuguese B2 level.