

Fatemeh Pourahmadian

Assistant Professor

Department of Civil, Environmental & Architectural Engineering

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Education

Ph.D. in Civil Engineering (Mechanics), 2011-2016

University of Minnesota, Twin Cities, MN

Cumulative GPA: 4.00/4.00

Thesis title: *A holistic approach to seismic waveform tomography of heterogeneous fractures:
From geometric reconstruction to interfacial characterization*

Advisor: Prof. Bojan B. Guzina, Co-advisor: Prof. Joe Labuz

M.Sc. in Geo-Engineering, 2015

University of Minnesota, Twin Cities, MN

Cumulative GPA: 4.00/4.00

Advisor: Prof. Bojan B. Guzina

M.Sc. in Mechanical Engineering (Vibrations & Control), 2007-2010

Iran University of Science and Technology, Tehran, Iran

Cumulative GPA: 18.85/20.00 (Rank: 1st in class)

Thesis title: *Modeling and identification of nonlinear systems with internal resonance*

Advisor: Prof. Hamid Ahmadian, Co-advisor: Dr. Hassan Jalali

B.Sc. in Mechanical Engineering, 2003-2007

University of Tabriz, Tabriz, Iran

Cumulative GPA: 17.35/20.00 (Rank: 2nd in class)

Thesis title: *FEM-based dynamic analysis of bogie frames under high-frequency wheel-rail excitation*

Advisor: Prof. Mohammad Zehsaz

Research and Professional Experience

Department of Civil, Environmental & Architectural Engineering, University of Colorado Boulder

2017– Assistant Professor

keywords: wave-based multiscale–multiphysics characterization of materials and structures;
laser-enabled in situ diagnostics; dynamics of fractures and material interfaces; dynamic
metamaterials and metastructures; deep learning approaches to inverse problems

Department of Applied Mathematics, University of Colorado Boulder

2019– Affiliated Faculty

keywords: physics-based data analytics in complex and uncertain environments;
inverse problems & imaging; multiscale modeling and homogenization;
asymptotic analysis, deep learning (physics-guided / scientific ML)

Department of Civil, Environmental & Geo- Engineering, University of Minnesota, Twin Cities

2016–2017 Postdoctoral Research Associate

2011–2016 Research Assistant

keywords: holistic approaches to waveform tomography and characterization of fractures,
high-frequency inverse scattering, 3D acoustic and elastic wave propagation in fractured media

Department of Mechanical Engineering, Iran University of Science and Technology, Tehran
Experimental Modal Analysis Laboratory

2010–2011 Research Associate

2008–2010 Research Assistant

keywords: inverse problems in nonlinear dynamics, mechanics of frictional interfaces,
nonlinear normal modes and their application to signal processing and system identification

Journal Publications

* highlights students advised and † indicates postdocs advised

- J29. Pourahmadian F (2025). “An energy-based spectral curriculum for FNO inference from limited and noisy experimental data”, *Mechanical Systems and Signal Processing*, under review.
- J28. Xu Y*, Pourahmadian F (2025). “BIE-guided Fourier neural operators for targeted subsurface characterization from surface measurements”, *Computer Methods in Applied Mechanics and Engineering*, under review.
- J27. Schmid A C*, Jensen E, Di Gioacchino F, Javadzadeh P B, Peterson N E, Becker C, Lu H, Pourahmadian F, Clarke A J, Doostan A, Regueiro R A (2025). “Calibrating a finite-strain phase-field model of fracture for bonded granular materials with uncertainty quantification”, *Journal of Applied Physics*, under review ([arXiv:2509.10484](https://arxiv.org/abs/2509.10484)).
- J26. Pourahmadian F, Xu Y* (2025). “Deep regularization networks for inverse problems with noisy operators”, *Journal of Computational Physics*, under review ([arXiv:2506.07008](https://arxiv.org/abs/2506.07008)).
- J25. Francis N M*, Shin D, Lebensohn R, Pourahmadian F, Dingreville R (2025). “Micropolar deep material network”, *Computer Methods in Applied Mechanics and Engineering*, **446**, 118329.
- J24. Song J*, Pourahmadian F, Murray T W, Narumanchi V V* (2025). “Laser ultrasonic imaging via the time-domain linear sampling method”, *IEEE Transactions on Computational Imaging*, **11**, 803–815.
- J23. Xu Y*, Pourahmadian F (2025). “Network scaling and scale-driven loss balancing for intelligent characterization of poroelastic systems”, *Journal of Computational Physics*, **537**, 114129.
- J22. Francis N M*, Lebensohn R, Pourahmadian F, Dingreville R (2024). “Micropolar elastoplasticity using a fast Fourier transform-based solver”, *International Journal for Numerical Methods in Engineering*, **126**(1), e7651.
- J21. Schmid A C*, Doostan A, Pourahmadian F (2024). “Ensemble WSINDy for data-driven discovery of governing equations from laser-based full-field measurements”, *Mechanical Systems and Signal Processing*, under revision ([arXiv:2409.20510](https://arxiv.org/abs/2409.20510)).
- J20. Francis N M*, Pourahmadian F, Lebensohn R, Dingreville R (2024). “A fast Fourier transform-based solver for micropolar composites”, *Computer Methods in Applied Mechanics and Engineering*, **418**, 116510.

- J19. Xu Y*, Pourahmadian F, Song J*, Wang C* (2023). "Deep learning for full-field ultrasonic characterization", *Mechanical Systems and Signal Processing*, **201**, 110668.
- J18. Narumanchi V V*, Pourahmadian F, Lum J, Townsend A, Tringe J W, Stobbe D M, Murray T W (2023). "Laser ultrasonic imaging of subsurface defects with the linear sampling method", *Optics Express*, **31**(5), 9098–9111.
- J17. Liu X*, Song J**, Pourahmadian F, Haddar H (2023). "Time- vs. frequency- domain inverse elastic scattering: Theory and experiment", *SIAM Journal on Applied Mathematics*, **83**(3), 1296–1314.
* authors equally contributed to this work.
- J16. Pourahmadian F, Haddar H (2023). "Ultrasonic imaging in highly heterogeneous backgrounds", *Proceedings of the Royal Society A*, **479**, 20220721.
- J15. Pourahmadian F, Napal K† (2022). "Poroelastic near-field inverse scattering", *Journal of Computational Physics*, **455**, 111005.
- J14. Pourahmadian F, Yue H* (2021). "Laboratory application of sampling approaches to inverse scattering", *Inverse Problems*, **37**, 055012.
- J13. Pourahmadian F (2021). "Experimental validation of differential evolution indicators for ultrasonic imaging in unknown backgrounds", *Mechanical Systems and Signal Processing*, **161**, 108029.
- J12. Pourahmadian F, Haddar H (2020). "Differential tomography of micromechanical evolution in elastic materials of unknown micro/macrostructure", *SIAM Journal on Imaging Sciences*, **13**(3), 1302–1330.
- J11. De Teresa I, Pourahmadian F (2018). "Real-time imaging of interfacial damage in heterogeneous composites", *SIAM Journal on Applied Mathematics*, **78**(5), 2763–2790.
- J10. Pourahmadian F, Guzina BB (2018). "On the elastic anatomy of fractures in rock", *International Journal of Rock Mechanics and Mining Sciences*, **106**, 259–268.
- J9. Pourahmadian F, Guzina BB, Haddar, H (2017). "A synoptic approach to the seismic sensing of heterogeneous fractures: from geometric reconstruction to interfacial characterization", *Computer Methods in Applied Mechanics and Engineering*, **324**, 395–412.
- J8. Pourahmadian F, Guzina BB, Haddar, H (2017). "Generalized linear sampling method for elastic-wave sensing of heterogeneous fractures", *Inverse Problems*, **33**, 055007 (33pp).
- J7. Pourahmadian F, Guzina BB (2015). "On the elastic-wave imaging and characterization of fractures with specific stiffness", *International Journal of Solids and Structures*, **71**, 126–140.
- J6. Guzina BB, Pourahmadian F (2015). "Why the high-frequency inverse scattering by topological sensitivity may work", *Proceedings of the Royal Society A*, **471**, 20150187 (28pp).
- J5. Pourahmadian F, Mogilevskaya SG (2015). "Complex variables-based approach for analytical evaluation of boundary integral representations of three-dimensional acoustic scattering", *Engineering Analysis with Boundary Elements*, **53**, 9–17.
- J4. Pourahmadian F, Ahmadian H, Jalali H (2012). "Modeling and identification of frictional forces at a contact interface experiencing vibro-impacts", *Journal of Sound and Vibration*, **331**, 2874–2886.
- J3. Jalali H, Ahmadian H, Pourahmadian F (2011). "Identification of micro-vibro-impacts at the boundary condition of a nonlinear beam", *Mechanical Systems and Signal Processing*, **25**, 1073–1085.
- J2. Zehsaz M, Tahami F, Asl A, Pourahmadian F (2011). "Effect of Increasing Speed on Stress of Biaxial Bogie Frames", *Engineering*, **3**(3), 276–284.

- J1. Ahmadian H, Jalali H, Pourahmadian F (2010). "Nonlinear model identification of a frictional contact support", *Mechanical Systems and Signal Processing*, **24**, 2844–2854.

Journal Publications in Preparation

- J34. Song J*, Wang C*, Pourahmadian F, Murray T W. "Super-resolution laser ultrasonic imaging via the multiplexed linear sampling method".
- J33. Pourahmadian F. "Friction through the lens of operator learning: Part I—Low-frequency, low-amplitude regime".
- J32. Song J*, Xu Y*, Pourahmadian F, Murray T W. "Automatic SVD truncation for imaging: A data-driven alternative to heuristic cutoffs".
- J31. Pourahmadian F, Narumanchi V V*, Murray T W. "Learning multifrequency regularizers for broadband ultrasonic imaging".
- J30. Pourahmadian F, Narumanchi V V*, Murray T W. "Neural Regularization of the Generalized Linear Sampling Method".

Invited Talks

- I18. Pourahmadian F (2025); collaborators: Noah M. Francis*, Dongil Shin, Ricardo A. Lebensohn, Remi Dingreville. "Micropolar Deep Material Network", *SIAM Conference on Computational Science and Engineering (SIAM CSE 25)*, Fort Worth, TX.
- I17. Pourahmadian F (2024); collaborators: Song J*, Xu Y*, Wang C*, Narumanchi V V, Murray T W, Schmid A C*, Doostan A. "Data-driven approaches for laser-based imaging and characterization of advanced materials", *Department of Applied Mathematics*, University of Washington, WA.
- I16. Pourahmadian F (2024); collaborators: Song J*, Xu Y*, Wang C*, Narumanchi V V, Murray T W, Lum J, Townsend A, Tringe J, Stobbe D M. "Intelligent Laser-based Sensing", *LLNL-CU Boulder Research Summit*, Boulder, CO.
- I15. Pourahmadian F (2023); collaborators: Murray T W, Narumanchi V V*, Lum J, Townsend A, Tringe J, Stobbe D M. "Laser ultrasonic imaging using the linear sampling method", *IEEE Research and Applications of Photonics In Defense Conference (RAPID)*, Miramar Beach, FL.
- I14. Pourahmadian F (2023); collaborators: Haddar H, Liu X, Murray T W, Narumanchi V V*, Song J*, Xu Y*. "Recent progress in inverse elastic scattering", *Colloquium, Department of Applied Mathematics and Statistics*, Colorado School of Mines, Golden, CO.
- I13. Pourahmadian F (2023); collaborators: Xu Y*, Song J*, Murray T W, Narumanchi V V*, Wang C*. "ML-assisted waveform inversion", *17th U. S. National Congress on Computational Mechanics (US-NCCM17)*, Albuquerque, NM.
- I12. Pourahmadian F (2023); collaborators: Xu Y*, Song J*, Wang C*, Murray T W, Narumanchi V V*, Haddar H, Liu X. "AI-augmented imaging and characterization of complex components", *Engineering Mechanics Institute (EMI) Dynamics Seminar Series*, [Virtual](#).
- I11. Pourahmadian F (2023); collaborators: Song J*, Narumanchi V V*, Xu Y*, Murray T W, Haddar H, Liu X. "Laser ultrasonic imaging via the sampling methods in time and frequency domains", *18th Annual Conference on Frontiers in Applied and Computational Mathematics (FACM 23)*, New Jersey Institute of Technology, Newark, NY.

- I10. Pourahmadian F (2022); collaborators: Song J*, Liu X, Haddar H. "Time- vs. frequency- domain ultrasonic tomography", *7th Annual Meeting of SIAM-CSS*, Oklahoma State University, OK.
- I9. Pourahmadian F (2021). "Recent progress on inverse scattering in highly heterogeneous solids", *6th Annual Meeting of SIAM-CSS*, University of Kansas, KS.
- I8. Pourahmadian F (2019); collaborator: Haddar H. "Recent advances on imaging in complex media", *Inverse Problems Seminar, Department of Mathematics*, Colorado State University, CO.
- I7. Pourahmadian F (2019); collaborator: Haddar H. "Waveform tomography in uncertain/unknown media", *SIAM annual meeting on recent progress in wave phenomena*, Laramie, WY.
- I6. Pourahmadian F (2018); collaborator: Haddar H. "Differential imaging of evolution in elastic back-grounds with unknown microstructure", *Colloquium, Applied Mathematics Department*, University of Colorado Boulder, CO.
- I5. Pourahmadian F (2017); collaborator: Guzina B B. "High-frequency inverse scattering by Topological Sensitivity", *Nonlinear Waves Seminar, Applied Mathematics Department*, University of Colorado Boulder, CO.
- I4. Pourahmadian F (2017); collaborators: Guzina B B, Haddar H. "Sounding of heterogeneous fractures in the subsurface", *Nonlinear Waves Seminar, Applied Mathematics Department*, University of Colorado Boulder, CO.
- I3. Pourahmadian F (2016); collaborators: Guzina B B, Haddar H. "Sounding of Heterogeneous Fractures in Geomaterials", *CEE Seminar*, Duke University, Durham, NC.
- I2. Pourahmadian F, Guzina B B, Haddar H (2015). "Active seismic imaging & characterization of fractures", *CEGE Seminar*, University of Minnesota, Minneapolis, MN.
- I1. Guzina B B, Pourahmadian F (2013). "Why the shape reconstruction by topological derivative may work", *CEGE Seminar*, University of Minnesota, Minneapolis, MN.

Technical Presentations

- TP40. Wang C*, Song J*, Pourahmadian F, Murray T W (2025). "Multiplexed laser ultrasonic imaging", *Engineering Mechanics Institute Conference*, Anaheim Marriott, Anaheim, CA.
- TP39. Song J*, Pourahmadian F, Xu Y*, Murray T W and Narumanchi V V* (2025). "ML-assisted linear sampling method for laser ultrasonic imaging", *Engineering Mechanics Institute Conference*, Anaheim Marriott, Anaheim, CA.
- TP38. Xu Y*, Pourahmadian F (2025). "A neural operator learning approach for subsurface characterization", *Engineering Mechanics Institute Conference*, Anaheim Marriott, Anaheim, CA.
- TP37. Francis N M*, Shin D, Lebensohn R, Pourahmadian F, Dingreville R (2024). "A deep material network using micropolar mechanics", *Engineering Mechanics Institute Conference*, Palmer House Hotel, Chicago, IL.
- TP36. Xu Y*, Pourahmadian F (2024). "A neural operator learning approach to model poroelastodynamics of rocks", *Engineering Mechanics Institute Conference*, Palmer House Hotel, Chicago, IL.
- TP35. Song J*, Pourahmadian F, Murray T W and Narumanchi V V* (2024). "Multiplexed laser ultrasonic imaging via the linear sampling method", *Engineering Mechanics Institute Conference*, Palmer House Hotel, Chicago, IL.

- TP34. Schmid A C*, Doostan A, Pourahmadian F (2024). "Data-driven discovery of governing equations and mechanical properties from experimental ultrasonic data with quantified uncertainty", *Engineering Mechanics Institute Conference*, Palmer House Hotel, Chicago, IL.
- TP33. Pourahmadian F, Xu Y*, Song J*, Murray T W and Narumanchi V V* (2024). "ML-regularized functionals for imaging in complex environments", *Engineering Mechanics Institute Conference*, Palmer House Hotel, Chicago, IL.
- TP32. Francis N M**, Lebensohn R, Pourahmadian F, Dingreville R (2024). "Micropolar elastoplasticity using fast Fourier transforms", poster presentation, *Material Research Summit*, Los Alamos, NM. *Invited.
- TP31. Schmid A C*, Doostan A, Pourahmadian F (2024). "Nondestructive evaluation of mock HE material properties", *PSAAP III CU Boulder Multidisciplinary Simulation Center (MSC) Tri-lab Sponsor Team (TST) Meeting*, Los Alamos, NM.
- TP30. Schmid A C*, Pourahmadian F, Doostan A (2023). "Data-driven discovery of equations governing ultrasonic wave motion", *17th U. S. National Congress on Computational Mechanics (USNCCM17)*, Albuquerque, NM.
- TP29. Francis N M*, Pourahmadian F, Dingreville R, Lebensohn R (2023). "An FFT solver for micropolar composites", *17th U. S. National Congress on Computational Mechanics (USNCCM17)*, Albuquerque, NM.
- TP28. Francis N M*, Pourahmadian F, Lebensohn R, Dingreville R (2023). "Fast, meshless evaluation of size-dependent materials", poster presentation, *Sandia Day*, University of Colorado Boulder, CO.
- TP27. Schmid A C*, Doostan A, Pourahmadian F (2023). "Governing equation and material property discovery with uncertainty quantification via laser ultrasonics", poster presentation, *Predictive Science Academic Alliance Program (PSAAP) Annual Review Meeting*, University of Colorado Boulder, CO.
- TP26. Xu Y**, Pourahmadian F, Song J*, Wang C* (2023). "Deep learning for full-field ultrasonic characterization", poster presentation, *18th Annual Conference on Frontiers in Applied and Computational Mathematics (FACM 23)*, New Jersey Institute of Technology, Newark, NY. *Invited.
- TP25. Schmid A C*, Doostan A, Pourahmadian F (2023). "Governing equation and material property discovery via laser ultrasonics", poster presentation, *Predictive Science Academic Alliance Program (PSAAP) Trilab Sponsor Team (TST) Meeting*, University of Colorado Boulder, CO.
- TP24. Song J**, Liu X, Pourahmadian F, Haddar H (2022). "Time-domain linear sampling method for in situ ultrasonic imaging", *Engineering Mechanics Institute Conference*, Johns Hopkins University, Baltimore, MD. *Jian won the best student paper award from the EMI Elasticity Committee.
- TP23. Xu Y*, Pourahmadian F (2022). "Deep learning tools for ultrasonic elastography", *Engineering Mechanics Institute Conference*, Johns Hopkins University, Baltimore, MD.
- TP22. Francis N M*, Dingreville R, Pourahmadian F (2022). "Micromorphic homogenization towards multi-scale metamaterial design", poster presentation, *Sandia Day*, University of Colorado Boulder, CO.
- TP21. Schmid A C*, Pourahmadian F, Doostan A (2022). "Verification and validation study for partial differential equation and material property discovery via laser ultrasonic experiments", poster presentation, *Predictive Science Academic Alliance Program (PSAAP) Annual Review Meeting*, University of Colorado Boulder, CO.
- TP20. Pourahmadian F, Yue H* (2021). "Experimental validation of differential evolution indicators", *Engineering Mechanics Institute Conference*, Virtual.

- TP19. Pourahmadian F (2021). "Data-driven characterization of micromechanical evolution in highly scattering solids", *14th World Congress on Computational Mechanics (WCCM XIV) and 8th European Congress on Computational Methods in Applied Science and Engineering (ECCOMAS 2020)*, Virtual.
- TP18. Napal K[†], Pourahmadian F (2020). "Detection and quantification of small cracks aggregates using artificial backgrounds", *Society of Engineering Science Conference*, Virtual.
- TP17. Pourahmadian F (2020). "Sampling-based approaches to laser ultrasonics", *Society of Engineering Science Conference*, Virtual.
- TP16. Pourahmadian F (2019). "Imaging in highly scattering composites", *Review of Progress in Quantitative Nondestructive Evaluation*, Portland, OR.
- TP15. Shakeri R*, Pourahmadian F (2019). "poroelastic imaging of hydraulic fractures", poster presentation, *Engineering Mechanics Institute Conference*, Caltech, CA; and *2019 Hilf Lecture*, Boulder, CO.
- TP14. Pourahmadian F, Yue H* (2019). "Differential imaging of evolution in elastic backgrounds with unknown microstructure", *Engineering Mechanics Institute Conference*, Caltech, CA.
- TP13. Pourahmadian F (2018). "Real-time imaging of microstructural damage in complex composites", *International Mechanical Engineering Congress & Exposition*, Pittsburgh, PA.
- TP12. Pourahmadian F (2018). "Real-time waveform tomography of damage precursors in complex composites", *Review of Progress in Quantitative Nondestructive Evaluation*, Burlington, VT.
- TP11. Pourahmadian F (2018). "3D seismic waveform tomography of subsurface fractures", *GRSG Oil and Gas Remote Sensing Workshop*, Boulder, CO.
- TP10. Pourahmadian F (2017). "Active monitoring of fracturing in quasi-brittle solids: an experimental study", *Engineering Mechanics Institute Conference*, UC San Diego, CA.
- TP9. Pourahmadian F, Guzina B B (2017). "Active ultrasonic imaging and interfacial characterization of stationary and evolving fractures in rock", *ISRM AfriRock - Rock Mechanics for Africa*, Cape Town, South Africa.
- TP8. Pourahmadian F, Guzina B B (2016). "Active Elastic-Wave Imaging of Heterogeneous Fractures: From Geometric Reconstruction to Interfacial Characterization", *Engineering Mechanics Institute Conference*, Vanderbilt University, Nashville.
- TP7. Pourahmadian F, Guzina B B (2015). "A hybrid approach to active seismic imaging of fractures: geometric reconstruction & interface characterization", *International Mechanical Engineering Congress and Exposition*, Houston.
- TP6. Pourahmadian F, Tokmashev R D, Risch P A, Guzina B B (2015). "Imaging and Characterization of Fracture Interface: An Experimental Study", *Review of Progress in Quantitative Nondestructive Evaluation*, Minneapolis, MN.
- TP5. Pourahmadian F, Guzina B B (2015). "Simultaneous recovery of fracture geometry and boundary condition at high frequencies", *Engineering Mechanics Institute Conference*, Stanford University, CA.
- TP4. Pourahmadian F, Tokmashev R D, Guzina B B (2015). "On the Elastic-wave Imaging and Interfacial Characterization of Heterogeneous Fractures", *IMA Hot Topics Workshop "hydraulic fracturing: from modeling and simulation to reconstruction and characterization"*, Institute of Mathematics and its Applications (IMA), Minneapolis, MN.

- TP3. Guzina B B, Pourahmadian F (2014). “Why the obstacle reconstruction by topological sensitivity may work”, *11th World Congress on Computational Mechanics (WCCM XI)*, Barcelona, Spain.
- TP2. Pourahmadian F, Guzina B B (2013). “Why the shape reconstruction by topological sensitivity may work”, *International Conference on Novel Directions in Inverse Scattering*, University of Delaware, DE.
- TP1. Pourahmadian F, Guzina B B (2013). “Qualitative identification of the interfacial condition in cracks via the method of topological sensitivity”, *Society of Engineering Science 50th Annual Technical Meeting*, Brown University, RI.

Refereed Conference Papers

- CP5. Pourahmadian F, Guzina B B, Haddar H (2017). “Generalized linear sampling method for active imaging of subsurface fractures”, *WAVES 2017*, Minneapolis, MN.
- CP4. Pourahmadian F (2017). “Real-time monitoring of heterogeneous fractures in rock: an experimental study”, *51st US Rock Mechanics/Geomechanics Symposium*, San Francisco, CA.
- CP3. Pourahmadian F, Guzina B B (2016). “Active ultrasonic imaging and interfacial characterization of stationary and evolving fractures in rock”, *50th US Rock Mechanics/Geomechanics Symposium*, Houston, Texas.
- CP2. Pourahmadian F, Ahmadian H, Jalali H (2010). “Identifying slip-slap forces in the contact interface using dual-mode excitation”, *International Conference on Noise and Vibration Engineering*, Leuven, Belgium, pp 1235-1244.
- CP1. Pourahmadian F, Jalali H, Ahmadian H (2010). “Identifying normal modes of a nonlinear system”, *10th International Conference on Recent Advances in Structural Dynamics*, Southampton, UK.

Funded proposals

As PI:

- Hierarchical design of metamaterials architectures for mechanical barriers via generalized homogenization and physics-informed neural networks, *SNL-CEAS Research Partnership*, CU-Boulder PI: Pourahmadian, SNL-PI: Remi Dingreville, \$270,000 (01/10/2022-09/30/2025)
- Real-time in situ Characterization of Evolving Rock Systems for Smart-controlled Subsurface Engineering: A Holistic Multiscale & Multiphysics Solution, *NSF CAREER*, PI: Pourahmadian, \$500,000 (06/01/2020-09/30/2025)
- Data-driven Engineering Science Seminars, *College of Engineering and Applied Science (CEAS) Interdisciplinary Seminars* (funds matched by the departments), Co-organizers: Pourahmadian (Civil Engineering/lead), Doostan (Aerospace Engineering), Becker (Applied Mathematic), Brown (Computer Science), Murray (Mechanical Engineering), Piestun (Electrical Engineering) \$11,000 (01/10/2022-12/30/2023)
- Differential Tomography of Evolution in Uncertain/Unknown Environments, *CU-Boulder Imaging Sciences-Interdisciplinary Research Themes (IS-IRT) Seed Grants*, PI: Pourahmadian, Collaborator: Appelo, \$20,000 (02/21/2019-12/30/2019)
- Real-Time Imaging and Characterization in Complex Composites, *CU-Boulder IS-IRT Seed Grants*, PI: Pourahmadian, Collaborator: Regueiro, \$30,000 (02/21/2018-12/30/2018)
- Imaging Science Seminar Grant, CU-Boulder IS-IRT, PI: Pourahmadian, \$5,000 (2018-2020)

As Senior Person:

- Center for micromorphic multiphysics porous and particulate materials simulations within exascale computing workflows, *PSAAP III*, PI: R. Regueiro, Co-PIs: J. Brown, A. Clarke, A. Doostan, H. Tufo, \$14M (06/01/20-09/30/26) Institutions: University of Colorado Boulder, Colorado School Mines, Columbia University, Stanford University, U of Tennessee, Knoxville, University of Texas Dallas;

Pourahmadian's share \$337,500

This project supported my PhD student Abby Schmid to develop a laser-enabled data-driven framework for calibration and V&V of the proposed computational platform with uncertainty quantification.

- Numerical Methods for Wave Equations in Time and Frequency Domain, *NSF DMS*, PI: Daniel Appelo, \$303,373 (06/15/2019-05/31/2022)

AY 2024-25 proposals

As PI:

- Data-driven discovery of the mechanics of frictional interfaces, submitted to *NSF ECI*, PI: Pourahmadian, \$442,358 (05/15/2025-05/14/2027), Pending
- Intelligent laser ultrasonic testing for super-resolution tomography in advanced manufacturing, submitted to *NSF DCSD*, PI: Pourahmadian, Co-PI: Murray \$440,682 (05/15/2025-05/14/2027), Declined (with positive reviews; resubmission encouraged)
- Hierarchical Design of Mechanical Barriers via Data-driven Synthesis of Generalized Continua, *NSF MOMS*, PI: Pourahmadian, Collaborators: Ricardo Lebensohn, Joseph Tringe, Todd Murray, \$427,527 (06/01/24-05/31/27), Declined
- Data-driven Synthesis of Hierarchical Materials for Extreme Dynamic Functionalities, submitted to *DOE CAREER*, PI: Pourahmadian, Collaborator: Ricardo Lebensohn, \$888,284 (10/01/2024-09/30/2029), Declined

Selected declined proposals

As PI:

- Frontiers in Nuclear Infrastructure: Safety, Monitoring and Regulation, *NRC-HQ-60-18-FOA-0001*, Young Faculty Recipients: F. Pourahmadian and Mija Hubler, Senior PIs: Ron Pak and Victor Saouma, \$600,000 (04/01/2018 - 03/31/2021)
- Real-time Remote Sensing of Treatment-Induced Hydraulic fractures in Unconventional Oil and Gas Reservoirs, *DOE DE-FOA-0001990*, PI: Pourahmadian, Co-PIs: Brice Lecampion, Smaïne Zeroug, Rich Regueiro, \$1,064,718 (9/1/19-8/31/22)
- General Scientific Infrastructure: 3D Scanning Laser Vibrometer for high-fidelity in situ characterization and prognosis of irradiated structural materials, *DOE-NEUP Full proposal*, PI: Pourahmadian, Collaborators: Victor Saouma, Rich Regueiro, Todd Murray, Remi Dingreville, \$550,000 (06/01/19-06/01/20)
- Differential imaging of evolution in highly heterogeneous composites with unknown micro/macrostructure, *NSF DCSD*, PI: Fatemeh Pourahmadian, Co-PI: Todd Murray, \$355,462 (10/1/19-9/30/22)
- A universal approach to elastic-wave cloaking, *CU-Boulder Seed Grants*, PI: Pourahmadian, Collaborator: Mahmoud Hussein, \$50,000 (02/15/17-08/15/18)

As Senior Person:

- NRT: Focusing Waves on Information, Safety, and Health (WISH), *NSF NRT*, PI: Todd Murray, Rafael Piestun, Stephen Becker, Carol Cogswell, \$3,000,000 (9/1/2019-8/31/2024)
- Inertial Surface Coating: New Paradigm for Silencing Structural Materials, *CU-Boulder Seed Grants*, PI: Mahmoud Hussein, Collaborator: Pourahmadian \$50,000 (02/15/17-08/15/18)

Scholarships & Fellowships

- Sommerfeld Fellowship (2011-2012)
Civil, Environmental & Geo- Engineering Department
University of Minnesota
- Daneshy Fellowship (Fall 2014, Fall 2015)
Civil, Environmental & Geo- Engineering Department
University of Minnesota

Honors & Awards (as student)

- Ranked 1st for the highest CGPA (class of 2010)
Mech. Eng. Department, Iran University of Science and Technology
- Outstanding Student Award (Fall 2009)
Mech. Eng. Department, Iran University of Science and Technology
- Ranked among top 2% of about 5,000 participants (2007)
National entrance exam for M.Sc. degree in Mech. Eng.
- Ranked 2nd for the highest CGPA (class of 2007)
Mech. Eng. Department, University of Tabriz
- Outstanding Student Award (Fall 2007)
Mech. Eng. Department, University of Tabriz
- Outstanding Student Award (Fall 2004)
Mech. Eng. Department, University of Tabriz
- Ranked among top 0.3% of about 400,000 participants (2003)
National entrance exam on math-physics for undergraduate studies
- Awarded in the 2nd round of national Mathematics Olympiad (1999)

Teaching

- CVEN 5151: Wave Methods for Design and Characterization of Advanced Materials (Spring 2017, 2019, 2021, 2023)

Wave Methods is a 3-unit graduate-level course that I developed upon arriving at CU Boulder and is offered every other spring. So far, first- or second-year PhD students in applied mathematics, physics, geology, civil, aerospace and mechanical engineering have taken this class. This course covers the key analytical concepts underlying data-driven approaches to design and characterization of systems involving wave motion.

- CVEN 5111: Structural Dynamics (Fall 2018, 2019, 2020, 2021, 2022)
- CVEN 3111: Analytical Mechanics II: Dynamics (Spring 2022, 2023, 2024, 2025, 2026)
- CVEN 2121: Analytical Mechanics I: Statics (Fall 2023, 2024)
- MCEN 2023: Statics & Structures (Fall 2024)
- CVEN 3718: Geotechnical Engineering II (Fall 2017, Spring 2019, 2020, 2021)

Advising

- **Postdocs:**

- Jian Song (Fall 2024 –)
- Yang Xu (Fall 2025 –)

Both Drs completed their PhDs in my group; see **Past PhD Students** for their work and accomplishments.

- **PhD Students:**

- Conglin Wang (Fall 2024 –)

develops novel laser-ultrasonic techniques for *in situ* process monitoring in advanced manufacturing and *ex situ* qualification or certification of fabricated parts. Conglin has co-authored two journal papers, including one in *Mechanical Systems and Signal Processing* while an undergraduate researcher; a second manuscript is in preparation (targeted for submission in Fall 2025).

- **Undergraduate Researchers:**

- Haonan Xu (Spring 2025 –)

develops neural preconditioners for automatic denoising of laser-based waveform measurements. Haonan plans to publish his work as a journal article, with submission targeted for 2026.

- **Past postdocs:**

- Kevish Napal (2019 – 2021)

Next: Postdoctoral Research Associate, Department of Mechanical Engineering, University of Sheffield

Kevish contributed to the mathematical framework of my NSF CAREER project and co-developed the theoretical foundation of poroelastic inverse scattering, published in the *Journal of Computational Physics*. Kevish also developed a robust multiphysics computational platform for modeling wave propagation through fracture networks in biphasic subsurface reservoirs.

- David Stobbe (Feb 2018 – Dec 2018)

Now: Deputy Group Lead, Nondestructive Evaluation group, Lawrence Livermore National Laboratory

David co-authored a journal article in *Optics Express* that demonstrates for the first time the applicability of sampling indicators (of the inverse scattering theory) for laser ultrasonic imaging via a set of laboratory experiments. David also contributed to the construction and calibration of the *Michelson* and *photorefractive* interferometers in my laboratory (the Laser Lab) that have been used for noncontact laser-based testing and diagnostics.

- Peter Kirkwood (2017 – 2018), 10% time

Next: Engineer at Tonkin and Taylor, New Zealand

Peter contributed to the development of a suite of laboratory experiments that mimic hydraulic fracturing; performed proof-of-concept studies to set model scales and verify sensor adequacy and data quality across the targeted frequency band. Our work formed the “Experimental Verification & Validation” component of my NSF CAREER project.

- **Past PhD students:**

- Yang Xu (Spring 2021 – Summer 2025)

Now: Postdoctoral Research Associate, Civil Engineering Department, CU Boulder

Next: Postdoctoral Research Associate, School of Mechanical Engineering, Purdue University (starting January 2026)

Supported by my NSF CAREER Award, Yang has developed deep-learning solutions for multiscale and multiphysics characterization of energy systems (In particular, unconventional geo-energy reservoirs) from near-field and remote waveform data. Yang’s accomplishments include: (i) five journal papers (two published, two under review, and one in preparation with submission targeted for Fall 2025); (ii) four conference presentations; and (iii) an invited presentation at the *18th Annual Conference on Frontiers in Applied and Computational Mathematics (FACM 2023)*. Yang’s work has also been showcased at several other national and international conferences and technical venues.

- Noah Francis (Fall 2021 – Summer 2025)

Now: Postdoctoral Research Associate, Center for Integrated Nanotechnologies (CINT), Sandia National Laboratories

Supported by a project with Sandia National Laboratories, Noah has developed a comprehensive data-driven framework for accelerated simulation and inverse design of hierarchical composites across micro-, meso-, and macro-scales. Noah’s accomplishments include: (i) three journal papers (two in *Computer Methods in Applied Mechanics and Engineering*); (ii) four conference presentations; and (iii) an invited presentation at Los Alamos National Laboratory.

- Abigail Schmid (Fall 2021 – Summer 2025); co-advised with Alireza Doostan of Aerospace Engineering
Next: Postdoctoral Research Associate, Los Alamos National Laboratory

Supported by the PSAAP III project, Abby has leveraged laser-based full-field measurements for data-driven discovery of the mechanics of particulate composites and calibration of the associated computer models with uncertainty quantification. Abby’s accomplishments include: (i) two journal papers, (ii) two conference presentations, and (iii) several technical talks at PSAAP events.

- Jian Song (Fall 2020 – Summer 2024)

Now: Postdoctoral Research Associate, Civil Engineering Department, CU Boulder

Next: Postdoctoral Research Associate, Mechanical Engineering Department, Penn State University

Funded by my startup, Jian worked on the theoretical foundation and experimental validation of the time-domain linear sampling method (TLSM) for high-fidelity nondestructive evaluation of safety-sensitive materials and components using laser ultrasonic testing. Jian’s accomplishments include: (i) five journal papers (three published and two in preparation with submission targeted for Fall 2025), (ii) four conference presentations, and (iii) winning the EMI Elasticity committee best student paper award for demonstrating the superior performance of TLSM compared to the more common frequency domain LSM indicator in the case of sparse and limited aperture test data. Jian was also awarded the Dissertation Completion Fellowship in Spring 2024.

- Vyjayanthi V Narumanchi (2021 – 2023); co-advised with Todd Murray of Mechanical Engineering

Now: Engineer at E Ink Corporation, CA

Supported by Lawrence Livermore National Laboratory (LLNL), NV (a PhD student in the Department of Electrical Engineering) pioneered the application of sampling-based imaging indicators to laser ultrasonics and demonstrated performance superior to state-of-the-art laser ultrasonic imaging methods. NV’s accomplishments include four journal papers (two published; two in preparation, with submission targeted for Fall 2025). NV’s work has also been presented at 10 national and international conferences and technical venues.

- **Past MSc students:**

- Abigail Schmid (2021 – 2025)
MS-PHD student
- Yang Xu (2021 – 2024)
MS-PHD student
- Jian Song (2020 – 2024)
MS-PHD student
- Bisman Singh (2023 – 2024)
Now: Data Scientist at Goldman Sachs, IL
Bisman was enrolled in the Applied Mathematics Professional Master's program and served as an hourly graduate researcher in my lab on *hierarchical neural modeling of waveguides*. He plans to submit a conference paper based on this work.
- Hao Yue (2019 – 2020)
Now: PhD student, Biomedical Engineering Department, City University of Hong Kong
MS-Thesis. Hao's accomplishments include: (i) a journal article in *Inverse Problems* reporting the first laboratory validation of the Generalized Linear Sampling Method (GLSM) and benchmarking it against the classical LSM, and (ii) a major role in establishing the Laser Lab as an undergraduate researcher.
- Greg Maris (2017–2018)
Now: Engineer at Knight Piesold, CO
MS-Report. Greg worked on experimental wave-based characterization of particulate materials.

- **Past undergraduate Researchers:**

- Conglin Wang (Summer 2022 – Summer 2024)
Subsequently joined my research group as a graduate student.
- Emily Szabo (Fall 2021 – Fall 2022)
Worked on the PSAAP III project.
- Jian Song (Fall 2019 – Fall 2020)
Subsequently joined my research group as a graduate student.
- Hao Yue (Fall 2017 – Fall 2019)
Subsequently joined my research group as a graduate student.

Service

- Member of the *Elasticity Committee* in the Engineering Mechanics Institute (EMI), Fall 2019 –
- Recognized for distinguished service to EMI as committee chair of the Elasticity Committee 2023 – 2025
As committee chair, I have attended the EMI Board of Governor's meeting and contributed to planning for future directions of the institute, its expansion, and ways to augment its revenue. I have chaired the annual Elasticity Committee meetings and worked with the committee members to draft an action plan for the future. I have processed new membership applications to the committee and facilitated the voting process. I coordinated the Elasticity Committee best student paper competition that involved a peer-review process and a presentation before the selection committee. I have also contributed to the organization of EMI Elasticity Committee Distinguished Lecture.
- Member of the *EMI Machine Learning In Mechanics Committee*, Fall 2021 –
- Member of the *EMI Dynamics Committee*, Fall 2021 –
- Member of the *EMI Properties of Materials Committee*, Fall 2021 –
- Chair of the *Data-driven Engineering Science Seminars*, College of Engineering & Applied Science, University of Colorado Boulder, 2022 – 2023

I initiated the data-driven engineering science seminars (DESS), a multidisciplinary seminar series in the College of Engineering and Applied Science (CEAS), dedicated to the most recent advances in data-driven modeling and characterization applied to emerging problems in engineering science. The focus was on deep learning solutions but rigorous approaches to inverse problems and novel experimental techniques were also included. DESS was co-organized by six faculty members from Applied Math, Computer Science, and (Aerospace, Mechanical, Electrical and Civil) Engineering, offering a perfect venue for interdisciplinary discussions, initiating collaborations, and dissemination of the research findings at the regional level. DESS garnered campus-wide interest and a relatively large group of audience (nearly 80 people signed up to receive DESS announcements).

- Chair of the *Imaging Science Seminar Series*, College of Engineering & Applied Science, University of Colorado Boulder, 2018 – 20

The Imaging Science seminars were in the form of weekly lectures given by scientists and engineers across the College of Engineering & Applied Science at CU Boulder as well as other institutions including universities, national laboratories and industry. This seminar series was sponsored by the Imaging Science IRT which brought together faculty and researchers from (a) Mechanical/Civil/Aerospace Engineering, (b) Applied Mathematics, (c) Physics, and (d) Chemistry Departments at CU as well as other regional institutions whose research interests reside in the broad area of Imaging Science with a wide spectrum of applications from microscopy, spectroscopy, laser acoustics, various biomedical imaging modalities to remote sensing, radar imaging and nondestructive evaluation of complex materials.

- Coordinator of the *Engineering Science Program*, University of Colorado Boulder, Fall 2021 – 2024

The Engineering Science Program at the Department of Civil, Environmental & Architectural Engineering (CEAE) aims at fostering interdisciplinary education and research at the intersection of Civil Engineering and Applied Sciences. In this vein, I chaired the Engineering Science Committee whose tasks included: (a) creating pathways to recruit and educate non-traditional graduate students, e.g., students with background in applied mathematics, computer science, and other engineering disciplines, to conduct fundamental research on emerging problems in Civil Engineering, and (b) enhancing collaboration and crosstalk between the CEAE and other departments (such as Applied Mathematics, Physics, Computer Science, Aerospace and Mechanical Engineering) e.g., by leading college-wide interdisciplinary seminar series and projects.

- Member of:

- CEAS Math Committee, December 2023 – May 2025
- CEAE Department Graduate R&A Committee, AY 2021– 2025
- CEAE Department Coursera Task Force, Fall 2024
- CEAE Department AI Task Force, Fall 2024
- CEAE Department Undergraduate Pathways Committee, AY 2022 – 2024
- CEAE Department Computer Committee, AY 2018 – 2023
- CEAE Department Curriculum Committee, AY 2017 – 18
- CEAS Imaging Science Search Committee, AY 2018 – 19

- Mentor in the NSF S-STEM Program (2019 – 2021)

Advising: Claudia Acosta-Pina, Michelle Amankwah, Erika Antunez

- PhD thesis committee member:

Niket Pathak (Mechanical Eng.), Rosa Morales (Mechanical Eng.), Enrique Chon (Geophysics), John Nardini (Applied Math), Clemence Bacquet (Aerospace Eng.), Jackson Bell (Geophysics)

- Reviewer for:

- NSF ECI (mail-in)
- NSF MOMS (panelist, mail-in)
- CU Boulder's Innovative Seed Grant
- CU Boulder's AB Nexus Grant
- CU Boulder's UROP Grant

- Co-chair of mini-symposium on:
 - digital twins, *45th Annual Review of Progress in Quantitative Nondestructive Evaluation*, Burlington, VT, July 2018 (with Steve Holland, Iowa State University)
 - novel methods in imaging & multiscale characterization of damage in complex materials, *Engineering Mechanics Institute Conference*, Caltech, CA, June 2019 (with Dianne Ezell, Oak Ridge National Lab)
 - physics-based data analytics for characterization of natural and architected systems, *Society of Engineering Science Conference*, Minneapolis, MN, October 2021 (with Bojan Guzina, University of Minnesota); postponed due to COVID
 - data-driven approaches to engineering mechanics, *Engineering Mechanics Institute Conference*, Johns Hopkins University, MD, June 2022 (with Jeong-Hoon Song)
 - data-driven approaches to engineering mechanics, *Engineering Mechanics Institute Conference*, Chicago, IL, May 2024 (with John Brigham, Alessandro Fascetti, Evgueni Filipov, Tom Seidl)
 - advances and applications of elasticity within applied mechanics, *Engineering Mechanics Institute Conference*, Chicago, IL, May 2024 (with John Brigham)
 - machine learning for computational solid mechanics, *SIAM Conference on Computational Science and Engineering (SIAM CSE 25)*, Fort Worth, TX, 2025 (with Tom Seidl, Jan Fuhg, and Reese E. Jones)
 - data-driven approaches to engineering mechanics, *Engineering Mechanics Institute Conference*, Anaheim Marriott, Anaheim, CA, May 2025 (with Hossein Salahshoor, Nicholas Vlassis, Jiun-Shyan Chen, QiZhi He, Waiching Sun, Audrey Olivier, Michael Shields, Lori Graham Brady)
- Referee for:
 - Proceedings of the Royal Society A
 - SIAM Journal on Applied Mathematics
 - Computer Methods in Applied Mechanics and Engineering
 - Geophysics
 - Journal of Computational Physics
 - Mechanical Systems and Signal Processing
 - Materials Evaluation
 - IMA Volumes in Mathematics and its Applications
 - Journal of Applied Physics
 - Inverse Problems
 - Inverse Problems in Science and Engineering
 - Ultrasonics
 - Nondestructive Testing and Evaluation
 - Journal of Engineering Mechanics
 - ASME Journal of Computing and Information Science in Engineering
 - ASME Journal of Vibration and Acoustics
 - International Journal of Mechanics and Materials in Design
 - International Journal of Rock Mechanics and Mining Sciences
- Member of:
 - Engineering Mechanics Institute (EMI)
 - Society for Industrial and Applied Mathematics (SIAM)
 - U.S. Association for Computational Mechanics (USACM)
 - Society of Engineering Science (SES)
 - American Rock Mechanics Association (ARMA)
 - American Society of Mechanical Engineers (ASME)
 - American Mathematical Society (AMS)