

# Leila Ghaffari

[GitLab](#) | [GitHub](#) | [ORCID](#) | [LinkedIn](#) | [Google Scholar](#) | +1 (303) 332-9872

## EDUCATION

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- **University of Colorado Boulder** Boulder, CO  
*PhD in Computer Science - GPA: 4.0* *Aug. 2019 – May 2025 (anticipated)*
- **Sharif University of Technology** Tehran, Iran  
*M.Sc in Chemical Engineering - GPA: 3.8* *Sep. 2013 – Jan. 2016*
- **University of Tehran** Tehran, Iran  
*B.Sc in Chemical Engineering - GPA: 3.0* *Sep. 2006 – Jun. 2011*

## EXPERIENCE

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- **University of Colorado Boulder** Boulder, CO  
*Graduate Research Assistant* *Aug. 2019 - Present*

**Faculty advisor:** [Jed Brown](#)

**Dissertation title:** Automation & Reliability in Computational Solid Mechanics

**Research:**

- Analyzing the performance and applicability of various Automatic Differentiation (AD) tools in computational solid mechanics, with a focus on modeling plasticity.
- Exploring robust iterative methods for solving under-constrained nonlinear problems with [PETSc](#) and [Ratel](#), a Finite Element Solver for computational solid mechanics built upon [libCEED](#).
- Added support for using AD tools, including [ADOL-C](#) and [Enzyme-AD](#), to Ratel for developing new constitutive models.
- Refactored and expanded [HONEE](#), a Finite Element Solver for Computational Fluid Dynamics.

- **Amazon Web Services (AWS)** San Francisco, CA  
*Research Science Intern* *Jun. 2024 - Aug. 2024*

*Design and Simulation Team, Center for Quantum Computing* - Added support for periodic boundary conditions to [awslabs/palace](#), an open source 3D Finite Element Solver for Computational Electromagnetics.

- **The National Center for Atmospheric Research (NCAR)** Boulder, CO  
*SIParCS Intern* *May 2021 - Jul. 2021*

Ported the Shallow Water Model mini-app with DPC++ (SYCL), and studied the performance of the ported code on several Intel CPU and GPU devices ([Performance Portability of Shallow Water Model with DPC++](#)).

## TECHNICAL SKILLS

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- **Programming Languages:** C/C++, Julia, Python, MATLAB, Scala, R
- **Software and Tools:** Git, Make, CMake, Linux Bash, Valgrind, GNU Debugger, Abaqus, SOLIDWORKS
- **High-Performance Computing:** Intel Advisor, DPC++, MPI, MPI I/O, OpenMP, Slurm

## PUBLICATIONS

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- Rezgar Shakeri, **Leila Ghaffari**, Jeremy L. Thompson, and Jed Brown. 2024. *Stable numerics for finite-strain elasticity*. International Journal for Numerical Methods in Engineering, 125(21). [doi:10.1002/nme.7563](#)
- Jed Brown, Valeria Barra, Natalie Beams, **Leila Ghaffari**, Matthew Knepley, William Moses, Rezgar Shakeri, Karen Stengel, Jeremy L. Thompson, and Junchao Zhang. 2022. *Performance Portable Solid Mechanics via Matrix-Free p-Multigrid*. [doi:10.48550/arXiv.2204.01722](#)

- Jed Brown, Ahmad Abdelfattah, Valeria Barra , Natalie Beams, Jean-Sylvain Camier, Veselin Dobrev, Yohann Dudouit, **Leila Ghaffari**, Tzanio Kolev, David Medina, Will Pazner, Thilina Rathnayake, Jeremy Thompson, Stan Tomov, *libCEED: Fast algebra for high-order element-based discretizations*, Journal of Open Source Software, 6(63), 2945, [doi:10.21105/joss.02945](https://doi.org/10.21105/joss.02945)

## HONORS AND AWARDS

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- **SIAM Student Travel Award** (\$950) - Jan. 2023
- **Clive Baillie Memorial Fellowship** (\$1200) - Department of Computer Science, CU Boulder - Oct. 2022
- **Clive Baillie Memorial Fellowship** (\$1000) - Department of Computer Science, CU Boulder - Oct. 2020

## TEACHING EXPERIENCE

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- **University of Colorado Boulder** Boulder, CO  
*Graduate Teaching Assistant* *Aug. 2023 - Dec. 2023*  
**Numerical Computation** (CSCI 3656): Designed computational assignments in Julia using nbgrader, held office hours, and graded assignments.
- **University of Tehran** Tehran, Iran  
*Teaching Assistant* *Jan. 2011 - May 2011*  
**Computer Aided Process Design and Simulation with Aspen HYSYS**: Helped students in modeling chemical processes using Aspen HYSYS.

## MENTORING EXPERIENCE

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- **Summer Program for Undergraduate Research** Boulder, CO  
*SPUR, CU Boulder*  
**Students**: David Reeder (2021), Kellen Davis Martin (2022), Clil Phillips (2023)  
**Advising Role**: Defined benchmarking projects on material models and tools in libCEED and Ratel, and guided the students through technical challenges and presentation preparation for final evaluation.

## ORGANIZATIONAL ENGAGEMENTS

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- **Local Organizer**, [EnzymeCon](#), Feb. 2023, 1st Enzyme Conference, CU Boulder
- **Executive Member**, 2nd National Conference on New Technologies for Environmental Pollution Control, Nov. 2013, Sharif University of Technology

## TECHNICAL REPORTS

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- Kolev, Tzanio, Fischer, Paul, Abdelfattah, Ahmad, Beams, Natalie, Brown, Jed, Camier, Jean-Sylvain, Carson, Robert, Chalmers, Noel, Dobrev, Veselin, Dudouit, Yohann, **Ghaffari, Leila**, Joshi, Aditya Y., Kerkemeier, Stefan, Lan, Yu-Hsiang, McDougall, Damon, Medina, David, Min, Misun, Mishra, Abhishek, Pazner, Will, Warburton, Tim. (2022). *CEED ECP Milestone Report: High-order algorithmic developments and optimizations for more robust exascale applications*. Zenodo. [doi:10.5281/zenodo.6514857](https://doi.org/10.5281/zenodo.6514857)
- Kolev, Tzanio, Fischer, Paul, Austin, Anthony P., Barker, Andrew T., Beams, Natalie, Brown, Jed, Camier, Jean-Sylvain, Chalmers, Noel, Dobrev, Veselin, Dudouit, Yohann, **Ghaffari, Leila**, Kerkemeier, Stefan, Lan, Yu-Hsiang, Merzari, Elia, Min, Misun, Pazner, Will, Rathnayaka, Thilina, Shephard, Mark S., Siboni, Morteza H., Warburton, Tim. (2021). *CEED ECP Milestone Report: High-order algorithmic developments and optimizations for large-scale GPU-accelerated simulations*. Zenodo. [doi:10.5281/zenodo.4672664](https://doi.org/10.5281/zenodo.4672664)
- Abdelfattah A., Barra V., Beams N., Brown J., Camier J. S., Dobrev V., Dudouit Y., **Ghaffari L.**, Kolev T., Medina D., Rathnayake T., Thompson J. L., Tomov S., *libCEED User Manual*, Version 0.7, Zenodo, September 2020. [doi:10.5281/zenodo.4302737](https://doi.org/10.5281/zenodo.4302737)

## TALKS

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- **SIAM Conference on Parallel Processing for Scientific Computing** Baltimore, Maryland  
*SIAM-PP24* Mar. 2024  
*Solving under-constrained hyperelasticity without the null space*  
**Leila Ghaffari**, Toby Isaac, and Jed Brown
- **American Physical Society** Las Vegas, Nevada  
*APS March Meeting 2023* Mar. 2023  
*Scale-Resolving Simulations of Turbulence at Extreme/Exa Scale*  
Kenneth E Jansen, Jed Brown, John A Evans, Riccardo Balin, James R Wright, and **Leila Ghaffari**
- **SIAM Conference on Computational Science and Engineering** Amsterdam, The Netherlands  
*SIAM-CSE23* Feb. 2023  
*Forward-Mode Enzyme in Developing Constitutive Models with Ratel*  
**Leila Ghaffari**, William Moses, Jeremy L Thompson, Karen Stengel, Rezgar Shakeri, and Jed Brown
- **Enzyme Conference 2023** Boulder, CO  
*EnzymeCon 2023* Feb. 2023  
*Automatic Differentiation in Solid Mechanics: Interpretation and Composition*  
**Leila Ghaffari**, William Moses, Jeremy L Thompson, Karen Stengel, Rezgar Shakeri, and Jed Brown
- **World and Asian Pacific Congresses on Computational Mechanics** Online  
*WCCM-APCOM 2022* Jul. 2022  
*On Performance portability of physical problems using libCEED*  
**Leila Ghaffari**, Valeria Barra, Jeremy Thompson, James Wright, and Jed Brown
- **SIAM Conference on Parallel Processing for Scientific Computing** Online  
*SIAM-PP22* Feb. 2022  
*On Portability and Performance Versatility in Nonlinear Solid and Fluid Mechanics Using libCEED and PETSc*  
**Leila Ghaffari**, Jeremy Thompson, Valeria Barra, Rezgar Shakeri, Karen Stengel, and Jed Brown
- **The National Center for Atmospheric Research (NCAR)** Online  
*SIParCS 2021* Jul. 2021  
*Performance Portability of Shallow Water Model with DPC++*  
**Leila Ghanffari** and Zephaniah Connell
- **SIAM Conference on Computational Science and Engineering** Online  
*SIAM-CSE21* Mar. 2021  
*Advances in LibCEED with Applications to Fluid and Solid Mechanics*  
**Leila Ghaffari**, Jeremy Thompson, Valeria Barra, and Jed Brown

## POSTERS

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- **The National Center for Atmospheric Research (NCAR)** Online  
*SIParCS 2021* Jul. 2021  
*Performance Portability of Shallow Water Model with DPC++*  
**Leila Ghanffari** and Zephaniah Connell

- **Exascale Computing Project Annual Meeting**

*2021 ECP Annual Meeting*

*LibCEED 0.8: Concepts and mini-apps*

Valeria Barra, Natalie Beams, Jed Brown, Yohann Dudouit, **Leila Ghaffari**, Arash Mehraban, Will Pazner, Rezgar Shakeri, and Jeremy Thompson

Online

*Apr. 2021*
- **SIAM Conference on Computational Science and Engineering**

*CSE21*

*LibCEED – The Finite Elements Library without Elements*

Valeria Barra, Jeremy Thompson, **Leila Ghaffari**, and Jed Brown

Online

*Mar. 2021*
- **AGU Fall Meeting**

*AGU2020*

*Efficient implementations for matrix-free solutions of PDEs with libCEED*

Valeria Barra, Jed Brown, Jeremy Thompson, **Leila Ghaffari**, Yohann Dudouit, and Natalie Beams

Online

*Dec. 2020*
- **Women in High Performance Computing Summit**

*WHPC*

*An open-source library for high-performance computing on heterogeneous architectures: libCEED*

Valeria Barra, Jed Brown, Yohann Dudouit, **Leila Ghaffari**, and Jeremy Thompson

Vancouver, Canada

*Apr. 2020*