

# Leila Ghaffari

Curriculum Vitae

October 2024

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Google Scholar : <https://scholar.google.com/citations?user=gW-Ve9sAAAAJ>

## SUMMARY

Interdisciplinary researcher specializing in scientific computing, high-performance computing, and software development. Experienced with automatic differentiation tools, finite element methods, and numerical linear algebra. Demonstrated ability to collaborate across disciplines and mentor students in research programs. Passionate about advancing automation and reliability in computational mechanics through innovative software solutions and performance optimization techniques.

## EDUCATION

- University of Colorado Boulder** Boulder, CO  
*PhD in Computer Science* *Aug. 2019 – Present*
- Sharif University of Technology** Tehran, Iran  
*M.Sc in Chemical Engineering* *Sep. 2013 – Jan. 2016*
- University of Tehran** Tehran, Iran  
*B.Sc in Chemical Engineering* *Sep. 2006 – Jun. 2011*

## EXPERIENCE

- University of Colorado Boulder** Boulder, CO  
*Graduate Research Assistant* *Apr. 2020 - Present*

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

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

- Contributing to [Ratel](#), a new solid mechanics software package built upon [libCEED](#) and [PETSc](#).
- Studying the performance and applicability of various AD tools in computational solid mechanics.
- Exploring the null spaces in singular linear systems with iterative methods.
- Contributed to [libCEED](#).

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

Design & Simulation Team, Center for Quantum Computing. Contributed to [awslibs/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++](#)).

- University of Colorado Boulder** Boulder, CO  
*Collaborating Researcher* *Apr. 2019 - Apr. 2020*

Expanded a Navier-Stokes solver mini-app for compressible gas dynamics in a three-dimensional geometry in [libCEED](#).

## TECHNICAL SKILLS

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- **Programming Languages:** C/C++, Python, Julia, MATLAB, Scala, R
- **Software and Tools:** Git, Make, Snakemake, Travis CI, Linux Bash, Valgrind, GNU Debugger, L<sup>A</sup>T<sub>E</sub>X, Abaqus, AutoCAD, SOLIDWORKS, ChemCAD, Aspen HYSYS, Enzyme-AD, ADOL-C, Zygote
- **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. [doi:10.1002/nme.7563](https://doi.org/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](https://doi.org/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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- **Student Travel Award (\$950)**  
*SIAM* *Jan. 2023*  
Awarded from the Society for Industrial and Applied Mathematics (SIAM) to attend the 2023 SIAM Conference on Computational Science and Engineering (CSE23).
- **Clive Baillie Memorial Fellowship (\$1200)**  
*Computer Science Department at CU Boulder* *Oct. 2022*  
Awarded from the Department of Computer Science at CU Boulder to attend the 2023 SIAM Conference on Computational Science and Engineering (CSE23).
- **Clive Baillie Memorial Fellowship (\$1000)**  
*Computer Science Department at CU Boulder* *Oct. 2020*  
Awarded from the Department of Computer Science at CU Boulder to attend the 2021 SIAM Conference on Computational Science and Engineering (CSE21).

## 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  
*Process Design with HYSYS* *Jan. 2011 - May 2011*  
Teaching assistant for **Computer Aided Process Design and Simulation with Aspen HYSYS**, a chemical process simulator used to mathematically model chemical processes, at the Chemical Engineering Department.

## MENTORING EXPERIENCE

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- **Summer Program for Undergraduate Research (SPUR)** Boulder, CO  
*University of Colorado Boulder*
  - Clil Phillips (Summer 2023)
  - Kellen Davis Martin (Summer 2022)
  - David Reeder (Summer 2021)

## 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, Ratnayaka, 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**  
*SIAM-PP22*

*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

Online  
Feb. 2022
- **The National Center for Atmospheric Research (NCAR)**  
*SIParCS 2021*

*Performance Portability of Shallow Water Model with DPC++*

**Leila Ghanffari** and Zephaniah Connell

Online  
Jul. 2021
- **SIAM Conference on Computational Science and Engineering**  
*SIAM-CSE21*

*Advances in LibCEED with Applications to Fluid and Solid Mechanics*

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

Online  
Mar. 2021

## POSTERS

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- **The National Center for Atmospheric Research (NCAR)**  
*SIParCS 2021*

*Performance Portability of Shallow Water Model with DPC++*

**Leila Ghanffari** and Zephaniah Connell

Online  
Jul. 2021
- **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