Zachary Atkins

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Education

2022–Present **Computer Science, PhD Student**, *University of Colorado, Boulder*, Boulder, CO
Coursework centering on numerical methods and high-performance scientific computing.
GPA: 4.0
Research experience:
○ Implemented Nitsche's method for modeling contact between elastic and rigid solid bodies in PSAAP-sponsored Ratel code;
○ Developed entropy variable implementation of Navier-Stokes fluid dynamics in PSAAP-sponsored libCEED code;

2016–2021 **Mathematics, BS with Honors**, *University of Kansas*, Lawrence, KS
Comprehensive background in algebra, analysis, and numerical mathematics. Electives in graduate level numerical partial differential equations and numerical analysis, including domain decomposition methods for partial differential equations, and real analysis.
GPA: 4.0 in major, 4.0 overall
Research experience:
○ Honors project on the application of decentralized optimization methods to edge devices;
○ Received university undergraduate research award for domain decomposition methods for eigenvalue problems;

2016–2021 **Computer Science, BS**, *University of Kansas*, Lawrence, KS
Comprehensive background in data structures, algorithms, and computing theory. Electives in artificial intelligence and computer graphics, as well as cross-major electives in numerical analysis.
GPA: 4.0 in major, 4.0 overall
Project Experience:
○ Video game and graphics development using Unity, PyGame, and OpenGL
○ Reinforcement learning with OpenAI using Python
○ C and C++ projects including functioning compiler and basic linux shell

Experience

Academic and Research

2023-Present **Graduate Research Assistant**, *University of Colorado Boulder*, Boulder, CO
Contributed to highly-performant, high-order and matrix-free solid mechanics code Ratel under the auspices of the Predictive Science Academic Alliance Program (PSAAP).
○ Implemented Nitsche's method-based for elastic-rigid contact;
○ Currently developing implicit, full Lagrangian material point method solver for simulation of granular materials.
Contact: Jed Brown, Associate Professor, jed.brown@colorado.edu

Fall 2022 **Graduate Teaching Assistant**, *University of Colorado Boulder*, Boulder, CO
Designed assignments aligning with curriculum and taught introductory programming in C++.
○ Led two recitation sections weekly consisting of over 70 students;
○ Facilitated over 30 cumulative hours of interview grading;
○ Created design documentation and rubrics for final class project, a text-based video game.
Contact: Tom Yeh, Associate Professor, tom.yeh@colorado.edu

2021–2022 **Academic Graduate Appointee**, *Lawrence Livermore National Laboratory*, Livermore, CA
Applied mathematical and computing principles to power system resilience through collaborative autonomy.
○ Collaborated with internal and external project contributors;
○ Led development of a wmoderately-sized software library to facilitate communication between grid devices;
○ Augmented existing numerical methods with robustness to communication delays and bad data.
Contact: Alyson Fox, Project Leader, fox33@llnl.gov

Summer 2020, **Computing Intern**, *Lawrence Livermore National Laboratory*, Livermore, CA
Spring 2021 Developed and analyzed algorithms for decentralized optimization in unreliable and communication-limited environments.
○ Principal author of internal technical report over studied algorithms;
○ Participated in Cybersecurity and Infrastructure Resilience competition:
  – Consisted of seven weekly cybersecurity and mathematics capture-the-flag challenges;
  – Placed first overall with all challenges completed;
○ Developed a comprehensive algorithm test suite using Python
Contact: Chris Vogl, Project Mentor, vogl2@llnl.gov

2020–2021	**Undergraduate Research Assistant**, *University of Kansas*, Lawrence, KS

Researched optimal optimal methods of domain decomposition for eigenvalue problems, particularly spectral Schur complement techniques. Continued research on decentralized optimization in collaboration with LLNL.
- Received Mathematics departmental undergraduate research award;
- Presented early results on domain decomposition for eigenvalue problems at 2020 Undergraduate Research Day at the Capitol;
- Presented at 2021 SIAM Conference on Computational Science and Engineering over:
  Using Decentralized Learning to Reduce Communication in Column-Partitioned, Multi-Agent Systems;

Contact: Agnieszka Międlar, Associate Professor, amiedlar@vt.edu

Spring 2020 **CTE Investigation Module Designer**, *University of Kansas*, Lawrence, KS

Advised curriculum and wrote programming projects for cross-discipline, upper-level undergraduate cryptographic methods class.
- Developed four python programming projects, including a simple RSA encryption implementation;
- Assisted students through office hours and supplementary materials;

Contact: Emily Witt, Associate Professor, witt@ku.edu

Software Engineering

Fall 2019 **Integrations Engineer**, *DEG Digital*, Olathe, KS
- Developed web API integrations with Salesforce Service Cloud triggers;
- Prototyped and developed AWS lambda functions for data-processing workflows;

Contact: Nick Aranzamendi, Engineering Manager, nickaranz@gmail.com

Summmer **Integrations Intern**, *DEG Digital*, Olathe, KS
2017–2019
- Developed Slack bot for automation of internal tasks;
- Prototyped quality assurance automation using Selenium WebDriver;

Contact: Greg Bustamente, Director of Engineering, gbustamante@degdigital.com

Miscellaneous

2016–2021 **Assistant Debate Coach**, *Lansing High School*, Lansing, KS

Instructed high school students on communication, argument construction, and strategic decision-making. Adjudicated debates over topics including immigration restrictions, reduction of US arms sales, and criminal-justice reform.
- Coached two NSDA Nationals top-speakers in World Schools Debate, as well as four teams placing 17th place or higher;
- Coached multiple national qualifying teams in policy debate;

Contact: Larissa Maranell, Head Debate Coach, larissa.maranell@usd469.net

Leadership

2017–2021 **Officer**, *KU Math Club*
- Vice President, Fall 2020 – Present
- Web and Social Media Chair, Fall 2017 – Fall 2020
- Created club website and managed social media pages
- Prepared meetings and coordinated with guest speakers

2014 **Eagle Scout**, *Boy Scouts Troop 165*, Lansing, KS
- Served in various leadership roles
- Organized community service project restoring a local park

Academic Honors

- Graduated with Highest Distinction in Mathematics and Computer Science
- Undergraduate Research Award in Mathematics, Spring 2020
- Phi Kappa Phi Honors Society, Member
- Upsilon Pi Epsilon Computer Science Honors Society, Member
- Tau Beta Pi Engineering Honors Society, Member
- University Honor Roll, Fall 2016 – Spring 2021
- University of Kansas Chancellor's Scholarship
- Babcock-Srinivasan Mathematics Scholarship
- Garmin Excellence Scholarship
- National Speech and Debate Association (NSDA), Member of Premier Distinction

Programming Languages

Python 3, *Advanced*

Extensive experience in scientific computing using packages such as `numpy`, `scikit-learn`, `pandas` and `matplotlib`. Additional experience in algorithm design and parallel programming with `multiprocessing` and `mpi4py`. Experience in user interaction and display management, both in a GUI using `Pygame` and in the command line, using `argparse`, `click`, and others. Strong understanding of design principles and best practices, including use of dataclasses and abstract base classes.

C++, *Advanced*

Experience in designing data structures, OpenGL, and systems programming using modern C++17 features. Strong understanding of object-oriented programming, data structures, and algorithms.

C, *Intermediate*

Experience developing PETSc-based finite element solvers in the context of computational solid mechanics. Experience in socket programming, including UDP and TCP, used to create a file transfer program, HTTP web server, and HTTP web proxy.

C#, *Intermediate*

Moderate experience in .NET framework and Unity.

Publications and Talks

[1] Zachary Atkins. Using decentralized learning to reduce communication in column-partitioned, multi-agent systems. Minisymposium Talk at *SIAM Conference on Computational Science and Engineering (CSE21)*, March 2021.

[2] Zachary Atkins, Alyson Fox, Agnieszka Międlar, Colin Ponce, and Christopher Vogl. The algorithmic development of a fully asynchronous conjugate gradient method. Talk at *17th Copper Mountain Conference on Iterative Methods*, April 2022.

[3] Zachary R Atkins, Christopher J Vogl, Achintya Madduri, Nan Duan, Agnieszka K Międlar, and Daniel Merl. Distribution system voltage prediction from smart inverters using decentralized regression. *2021 IEEE Power & Energy Society General Meeting (PESGM)*, July 2021.

[4] Lucas Erlandson, Zachary Atkins, Alyson Fox, Christopher Vogl, Agnieszka Miedlar, and Colin Ponce. Resilient s-acd for asynchronous collaborative solutions of systems of linear equations. In *Annals of Computer Science and Information Systems*, volume 35, pages 441–450, 2023.