



## EDUCATION

### Applied Mathematics M.S.

University of Colorado Boulder

2020 – 2022

GPA: 3.863

### Applied Mathematics B.S.

University of Colorado Boulder

2017 – 2020

GPA: 3.933

Minor: Computer Science


## SKILLS


Python PyTorch Julia C++ C#  
C LaTeX Linux Git HPC CAD  
German


## COURSES

Deep Learning Optimization  
Functional Analysis Real Analysis  
Complex Analysis Differential Eqs.  
Machine Learning Linear Algebra  
Probability Statistics Algorithms  
Numerics Algorithmic Economics


## SOFTWARE\*

 **RSFN** **Lead**  
Julia implementation of R-SFN optimization algorithm

 **PyTorch-QuadConv** **Co-Lead**  
Quadrature-based convolutions for deep learning in PyTorch

 **PyTorch-ARC** **Lead**  
PyTorch implementation of the Adaptive Regularization with Cubics optimization algorithm

## CERTIFICATIONS

 **Solidworks Associate**  
Certified with a perfect score on the CSWA exam in May 2019.

## WORK EXPERIENCE\*

### Staff Scientist

Aerospace Mechanics Research Center

May 2022–Present

CU, Boulder

- Investigating large-scale compression of PDE simulation data via autoencoding neural networks
- Developed QuadConv, a quadrature-based convolution operator for use in deep learning on unstructured and non-uniform meshes
- Working with multiple supercomputer systems through Argonne Leadership Computing Facility (Polaris & Theta) and CU Boulder (Alpine & Blanca)

### Development Intern

Electro Magnetic Applications (EMA3D)

June–Aug 2021

Denver, CO

- Developed production software for Charge and Cable – electromagnetic simulation tools
- Implemented generalized barycentric interpolation for arbitrary convex polyhedra
- Built post-processing functionality for complex unstructured 3D meshes

### Teaching & Course Assistantships

College of Engineering

Variable 2018–2021

CU, Boulder

- Ran recitations and office hours helping to teach students fundamental skills in mathematics
- Developed course material, and worked with faculty members to maintain an organized and effective teaching environment

Differential Eqs. & Linear Algebra (TA) Calculus 1 (TA) Applied Probability (CA)  
Data Structures (CA) Starting Computing (CA)

## PROJECTS & PUBLICATIONS\*

### Regularized Saddle-Free Newton **Master's Thesis**

Presents R-SFN: a novel second-order method for non-convex optimization. A non-linear transformation to the Hessian in Newton's method provides provable saddle-avoidance and an efficient matrix-free implementation.

- Cooper Simpson. "Regularized Saddle-Free Newton: Saddle Avoidance and Efficient Implementation". M.S. Thesis. Dept. of Applied Mathematics, CU Boulder, 2022

### Quadrature-Based Convolutions **CU Research**

Introduces QuadConv, a quadrature-based discrete convolution operator suitable for non-uniform data. We show it can match the effectiveness of traditional discrete convolutions for autoencoder based data compression, and it can achieve similar performance when the data exists on a non-uniform mesh.

- Kevin Doherty, Cooper Simpson, et al. "QuadConv: Quadrature-Based Convolutions with Applications to Non-Uniform PDE Data Compression". In: *arXiv* (2022). DOI: 10.48550/ARXIV.2211.05151

### Neural Networks for Microcontrollers **Correll Robotics Lab**

A Python package for translating trained neural networks into C code for use in embedded systems.

- S. Aguasvivas, D. Hughes, C. Simpson, et al. "Embedded Neural Networks for Robot Autonomy". In: *Robotics Research*. Cham: Springer International Publishing, 2022, pp. 242–257. DOI: 10.1007/978-3-030-95459-8\_15