Amit Rotem

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EDUCATION

Virginia Tech — Blacksburg, VA
Ph.D., Mathematics — In progress
GPA: 3.9

Michigan State University — East Lansing, MI
Ph.D., Computational Mathematics, Science, and Engineering — Transfered to VT
GPA: 4.0

Colorado School of Mines — Golden, CO
M.S., Computational and Applied Mathematics. — May, 2021
GPA: 4.0
B.S., Applied Mathematics and Statistics. — May, 2020
GPA: 3.6

TECHNICAL SKILLS

Programming Languages: C++, Python, Julia, and MATLAB.

Numerical Analysis: High order methods for partial differential equations.

High Performance Computing: Efficient and scalable implementation of numerical methods. Parallel programming using MPI, OpenMP, and CUDA in C/C++.

Machine Learning: Algorithms and applications; experience with scikit-learn, and Keras/Tensorflow in Python.

PUBLICATIONS

- Rotem A, Runborg O, Appelö D, Convergence of the Semi-Discrete WaveHoltz Iteration. Preprint available at https://arxiv.org/abs/2407.06929
- Rotem A, Vidal A, Pfaff K, Tenorio L, Chung M, Tharalson E, Monecke T. Interpretation of Hyperspectral Shortwave Infrared Core Scanning Data Using SEM-Based Automated Mineralogy: A Machine Learning Approach. *Geosciences.* 2023; 13(7):192. https://doi.org/10.3390/geosciences13070192
- Carter S, Rotem A, Walker SW. A domain decomposition approach to accelerate simulations of structure preserving nematic liquid crystal models. *Journal of Non-Newtonian Fluid Mechanics.* 2020;283:104335. https://doi:10.1016/j.jnnfm.2020.104335

PRESENTATIONS

- Rotem A, Runorg O, Appelö D, New Convergence Results for the WaveHoltz Algorithm. *Poster at SIAM Central States Annual Meeting 2024.* Recieved best poster award.
- Rotem A, Runborg O, Appelö D, New Convergence Results for the WaveHoltz Algorithm. *Extended abtract and presentation at the Waves 2024 conference.*
- Rotem A, Pazner W, Appelö D, GPU Acceleration of IPDG in MFEM. *Presentation at Finite Element Circus in October, 2023.*
- Rotem A, Runborg O, Appelö D, New Convergence Results for WaveHoltz with Application to Impedance Boundary Conditions. *Presentation at AMS Central Sectional Conference in April, 2023.*
- Rotem A, Appelo D, Runborg O, Application of the Hetergeneous Multiscale Method to Solving the Helmholtz Equation via WaveHoltz Iteration. *Extended abstract and presentation at the Waves 2022 conference.*
- Numerical Experiments in Domain Decomposition for Simulating Liquid Crystal Defects. *Poster and presentation at Summer Undergraduate Research Forum at LSU.*
- Increasing the Value of Hyperspectral Data. *Poster and presentation for CASERM an NSF industry/university cooperative research center.*

PROJECTS & EXPERIENCE

LLNL Computing Scholars Program: GenDiL **Summer 2024**

Lawrence Livermore National Laboratory internship. Implemented high performance (GPU) matrix free DG discretizations in arbitrary number of dimensions. Intended applications include six dimensional kinematic equations.

- Code: https://github.com/GenDiL/GenDiL

High Performance Discontinuous Galerkin in MFEM **Spring 2023 - Present**

Implemented a matrix free interior penalty DG discretization in two and three dimensions in the MFEM library. Optimized code for GPU computing with CUDA.

- Code: https://mfem.org/

Convergence Results for WaveHoltz **Summer 2022 - Present**

Developed convergence results that generalize the current results for the WaveHoltz iteration to a broader class of problems. Constructed and analyzed examples with application to impedance boundary conditions. Presented the preliminary results at AMS Central Sectional Conference in April 2023.

- Preprint: https://arxiv.org/abs/2407.06929

WaveHoltz-HMM **Fall 2021 - Present**

Researched the use of the heterogeneous multiscale method (HMM) to find homogenized solutions to the variable coefficient wave-equation in the frequency domain via the WaveHoltz iterative algorithm. Presented the preliminary results of the project at WAVES 2022. Paper in progress.

Parallel Computing Teaching Assistant **Spring 2023**

Assisted in flipped classroom setting. Guided students through coding exercises and the learning of OpenMP and MPI. Graded assignments.

CASERM: ML Models Adding Value to Hyperspectral Data **Spring 2019 - Spring 2021**

Developed predictive models and data analysis workflow for geological imaging data in an interdisciplinary research team. These models include: a statistical model for predicting mineralogy labels from hyperspectral images; an image segmentation model for extracting interpretable data; clustering and classification models for cleaning data. Presented a poster at an NSF conference in March 2020 and published a peer reviewed paper in Geosciences in 2023.

- **Paper:** https://doi.org/10.3390/geosciences13070192

Rincon ML Research Internship **Summer 2020**

Investigated applications and performance of HoloClean, a deep-learning API for database cleaning and enriching. Developed a testing environment in Python using various real world data sets (including image data) as well as complex artificial ones.

Simulating Liquid Crystal Defects (REU) **Summer 2019**

Demonstrated the effectiveness of an iterative domain decomposition approach to a locally stiff finite element problem. Conducted numerical experiments. Presented results at the Summer Undergraduate Research Forum at LSU. Peer reviewed paper published in Elsevier Journal of Non-Newtonian Fluid Mechanics.

- **Paper:** https://doi.org/10.1016/j.jnnfm.2020.104335

Multivariate Calculus Teaching Assistant **Spring 2018 - Spring 2019**

Explained concepts of multivariate calculus to students, and guiding students' through problem solving. Graded assignments.

AWARDS

Best Poster Award at SIAM Central states annual meeting 2024.

Engineering Distinguished Scholar Award at Michigan State University providing financial scholarship for the duration of the graduate program.

The Professor Everett Award at Colorado School of Mines for scholarship, leadership, community service and the potential for the innovative application of mathematics to mineral engineering.