

Jackson Vanover

*Leveraging static and dynamic analyses to maximize the performance
and correctness of numerical code in the field of HPC*

Education

Expected: **PhD in Computer Science** at *University of California, Davis*
Summer 2025
2018 to 2020 **MS in Computer Science** at *University of California, Davis*, GPA: 4.0
2012 to 2016 **BA in Mathematics** at *University of California, Santa Cruz*, Major GPA: 3.92

Experience

Jan 2019 to Present **Graduate Researcher** with the *UCD-PLSE Research Group*, UC Davis
Focus on designing strategies and developing tools for numerical software with an emphasis on the correctness and performance of floating-point computation in high-performance computing applications.
Summer '21, '22 **Graduate Student Computing Researcher**, Lawrence Livermore National Laboratory
Researching novel techniques for the analysis of numerical software to facilitate the optimization of high-performance computing applications via approximation.

Selected Projects

EXCVATE: Testing Exception Handling in Foundational Linear Algebra Libraries

Collaboration with the Principal Investigators of the LAPACK and BLAS linear algebra libraries to devise a tool combining binary instrumentation and SMT solvers to test library exception handling. Resulted in a first-author publication at the 2025 International Symposium on Computer Arithmetic (ARITH) with an accompanying **"Best Paper" award**.

Prose: Optimizing the Performance of Large-Scale Climate Modeling Software

Collaboration with the Climate & Global Dynamics Laboratory at the National Center for Atmospheric Research to research automated precision tuning optimizations for weather/climate code. Resulted in a first-author publication at the 2024 International Workshop on Software Correctness for HPC Applications.

FPDiff: Automated Differential Testing for Bug-Finding in Numerical Libraries

Led a team focused on improving the robustness of numerical software that resulted in the FPDiff tool. Resulted in a first-author publication at the 2020 International Symposium on Software Testing and Analysis (ISSTA) with an accompanying **"Distinguished Artifact" award**.

Areas of Interest

- Input-Aware Performance Optimization
- Handling of Floating-Point Exceptions
- Mixed-Precision Floating-Point
- Formal Verification of Low-Level Software

Skills

Languages Fortran, C++, x86 Assembly, Python, Bash
Techniques Binary Instrumentation/Analysis, Search-Based Optimization, SMT Solvers, Automated Program Transformation

References

Dr. Cindy Rubio-González *Advisor at UCD // (530) 752-7069 // crubio@ucdavis.edu*
Dr. Harshita Menon *Advisor at LLNL // (650) 741-4260 // harshitha@llnl.gov*
Dr. Alper Altuntas *Collaborator at NCAR // (919) 649-9980 // altuntas@ucar.edu*

Publications listed on following page

Publications

- Awarded "Best Paper"** **Vanover, Jackson**, James Demmel, Xiaoye Sherry Li, and Cindy Rubio-González. "EXCVATE: Spoofing Exceptions and Solving Constraints to Test Exception Handling in Numerical Libraries." *Proceedings of the 32nd IEEE International Symposium on Computer Arithmetic*. Accepted, expected May 2025. (Preprint available at www.arith2025.org/proceedings/215900a109.pdf)
- Vanover, Jackson**, Alper Altuntas, and Cindy Rubio-González. "Toward Automated Precision Tuning of Weather and Climate Models: A Case Study." *2024 IEEE/ACM 8th International Workshop on Software Correctness for HPC Applications (Correctness)*. IEEE, 2024.
- Menon, Harshitha, James Diffenderfer, Giorgis Georgakoudis, Ignacio Laguna, Michael O. Lam, Daniel Osei-Kuffuor, Konstantinos Parasyris, and **Jackson Vanover**. "Approximate High-Performance Computing: A Fast and Energy-Efficient Computing Paradigm in the Post-Moore Era." *IT Professional* 25, no. 2 (2023): 7-15.
- Parasyris, Konstantinos, James Diffenderfer, Harshitha Menon, Ignacio Laguna, **Jackson Vanover**, Ryan Vogt, and Daniel Osei-Kuffuor. "Approximate computing through the lens of uncertainty quantification." In *SC22: International Conference for High Performance Computing, Networking, Storage and Analysis*. 2022.
- Awarded "Distinguished Artifact"** **Vanover, Jackson**, Xuan Deng, and Cindy Rubio-González. "Discovering discrepancies in numerical libraries." *Proceedings of the 29th ACM SIGSOFT International Symposium on Software Testing and Analysis*. 2020.